



Federal Office
for Information Security

Technical Guideline TR-03122-3

Conformance Test Specification for BSI TR-03121 Biometrics for Public Sector Applications

Part 3: Test Cases for Function Modules and Processes

Version 6.0



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1 Introduction

This document is part three of the Conformance Test Specification (TR-03122). It is the counterpart of TR-03121-3 describing the test cases for the defined Function Modules.

Not all Function Modules have test cases associated with them.

2 Test Cases Function Modules

The following sections define test cases for Function Modules.

2.1 Test Cases Acquisition Hardware

2.1.1 Test Cases FM AH-ALL-SSS

Test Case ID: TC-AH-ALL-SSS-001

Scope Examination of the surveillance camera systems of the self-service system (SSS) used for to obtain digitised facial images and fingerprints.

Preconditions

- The Implementation Under Test (IUT)'s SSS is ready for operation.
- A environment surveillance camera system which supervises the area around the SSS is available.
- A environment surveillance camera system which supervises the fingerprint capture system of the SSS is available.
- The IUT implements a graphical user interface.
- The IUT implements a user interface of fingerprint acquisition shown to the biometric subject.
- Two test subjects are available to test the IUT's behaviour.

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-AH-ALL-SSS-001/1

Table 2.2 TC-AH-ALL-SSS-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject initiates the SSS process of the IUT. • Perform a bona fide fingerprint presentation on the fingerprint scanner of the IUT. • Interact with the graphical user interface of the IUT. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT delivers a response that is conformant to the schema file trbio5v1.xsd. • A fingerprint image is captured. • The surveillance camera system captures a colour image of the surrounding area at the moment of the finger capture attempt in which the face of the biometric subject using the fingerprint scanner is visible. • The surveillance camera system captures a colour image of the fingerprint acquisition area at the moment of the finger capture attempt. • The images captured by the surveillance camera systems are cached locally. • The image captured by the surveillance camera system has a resolution of at least 1280 x 720. • The differences of capture times between the images captured by the surveillance camera systems and the fingerprint capture attempt image are logged and below 100 ms.
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject initiates the SSS process of the IUT.

Test Case ID: TC-AH-ALL-SSS-001

	<i>Expected Result:</i>
	<ul style="list-style-type: none"> The IUT starts the SSS process and enables interaction via the graphical user interface.
3	<p><i>Description:</i></p> <ul style="list-style-type: none"> A second biometric subject moves into the corridor of the SSS (distance of 100cm in front the SSS). <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> The image captured by the surveillance camera system of the surrounding area allows to identify whether that more than one person is in range of the SSS.
4	<p><i>Description:</i></p> <ul style="list-style-type: none"> Both biometric subjects leave the corridor of the SSS. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> The IUT stops the SSS process.

Table 2.1 Test Case ID: TC-AH-ALL-SSS-001

2.1.2 Test Cases FM AH-FI-BCL

Test Case ID: TC-AH-FI-BCL-001

<i>Scope</i>	Examination of technical specifications of the digital camera used to obtain facial biometrics.						
<i>Preconditions</i>	<ul style="list-style-type: none"> The camera used in the specific application profile is at hand and ready for operation. Product documentation of the camera model is at hand (e.g. data sheet, manual). 						
<i>CTS Mode</i>	Not supported						
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Consult product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the camera system supports the capture of color images.</p> </td> </tr> <tr> <td>2</td> <td> <p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height in the range of 140 cm to 200 cm.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Consult product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the camera system supports the capture of color images.</p>	2	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height in the range of 140 cm to 200 cm.</p>
Step	Description / Expected Result						
1	<p><i>Description:</i></p> <p>Consult product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the camera system supports the capture of color images.</p>						
2	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height in the range of 140 cm to 200 cm.</p>						

Table 2.3 Test Case ID: TC-AH-FI-BCL-001**Test Case ID: TC-AH-FI-BCL-002**

<i>Scope</i>	Examination of image resolution and cropping features of the digital camera used to obtain facial biometrics.
<i>Preconditions</i>	<ul style="list-style-type: none"> The camera used in the specific application profile is at hand and ready for operation. The IUT implements an interface for conformance testing where a single image can be captured. The IUT is able to return the results for every captured image via the test interface. One test subject is available to test the Implementation Under Test (IUT)'s behaviour.

Test Case ID: TC-AH-FI-BCL-002

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-AH-FI-BCL-002/1

Table 2.5 TC-AH-FI-BCL-002 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Position the biometric subject in a distance of 60 cm towards the camera system. • Acquire an image with the camera system via the CTS interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>). • The CTS verifies that the image returned by the IUT has a resolution of 1600 x 1200 pixels with a maximal deviation of -10%.

Table 2.4 Test Case ID: TC-AH-FI-BCL-002**Test Case ID: TC-AH-FI-BCL-003**

Scope Examination of image processing features of the digital camera or provided/integrated software used to obtain facial biometrics.

- Preconditions*
- The camera used in the specific application profile is at hand and ready for operation.
 - The IUT implements an interface for conformance testing where a single image can be captured.
 - The IUT is able to return the results for every captured image via the test interface.
 - Two biometric test subjects are available to test the IUT's behaviour.

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-AH-FI-BCL-003/1

Table 2.7 TC-AH-FI-BCL-003 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Position one biometric subject in front of the camera system. Verify that this biometric subject is standing in a distance above 40 cm and below 100 cm to the camera system. • Position the second biometric subject in front of the camera system. Verify that the biometric subject is standing in a distance below 40 cm to the camera system. • Attempt to acquire an image with the camera system by using the CTS.

Test Case ID: TC-AH-FI-BCL-003

Expected Result:

- The camera system does not acquire an image.
- A message conforming to TR-03121 XML but not containing facial image data is returned via the test interface (bio:FaceAcquisition).

Table 2.6 Test Case ID: TC-AH-FI-BCL-003

Test Case ID: TC-AH-FI-BCL-004

<i>Scope</i>	Examination of image processing features of the digital camera or provided/integrated software used to obtain facial biometrics.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The camera used in the specific application profile is at hand and ready for operation. • The IUT implements an interface for conformance testing where a single image can be captured. • The IUT is able to return the results for every captured image via the test interface. • Two biometric test subjects are available to test the IUT's behaviour.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-AH-FI-BCL-004/1

Table 2.9 TC-AH-FI-BCL-004 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Position one biometric subject in front of the camera system. Verify that this biometric subject is standing in a distance above 40 cm and below 100 cm to the camera system. • Position the second biometric subject in front of the camera system. Verify that the biometric subject is standing in a distance above 100 cm to the camera system. • Acquire an image with the camera system by using the CTS. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition). • The returned image depicts the biometric subject which was positioned in a distance above 40 cm and below 100 cm to the camera system.

Table 2.8 Test Case ID: TC-AH-FI-BCL-004

2.1.3 Test Cases FM AH-FI-DC

Test Case ID: TC-AH-FI-DC-001

<i>Scope</i>	Examination of technical specifications of the facial image camera used to obtain facial biometrics. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.	
<i>Preconditions</i>	<ul style="list-style-type: none"> • The camera used in the specific application profile is at hand • Product documentation of the camera model is at hand (e.g. data sheet, manual) 	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result

Test Case ID: TC-AH-FI-DC-001

1	<p><i>Description:</i></p> <p>Verify that the sensor of the camera provides a physical resolution of at least 1200 x 1600 pixels.</p> <p>Consult product documentation of the camera.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the physical, native resolution is at least 1200 x 1600 pixels.</p>
2	<p><i>Description:</i></p> <p>Verify that the active camera setting (e.g. configurable via camera firmware) used for the specific application provides an image resolution of at least 1200 x 1600 pixels.</p> <p>Consult product documentation of the camera or options in the cameras firmware.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The setting provides a native image resolution of at least 1200 x 1600 pixels. • This setting is the active setting for the application profile

Table 2.10 Test Case ID: TC-AH-FI-DC-001**Test Case ID: TC-AH-FI-DC-002**

<i>Scope</i>	Examination of technical specifications of the digital camera used to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.				
<i>Preconditions</i>	Product documentation of the camera unit is at hand (e.g. data sheet, manual).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the digital camera provides a 24 bit sRGB mode. • Consult product documentation of the digital camera. <p><i>Expected Result:</i></p> <p>The product documentation states that the digital camera is able to capture images in 24 bit sRGB.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the digital camera provides a 24 bit sRGB mode. • Consult product documentation of the digital camera. <p><i>Expected Result:</i></p> <p>The product documentation states that the digital camera is able to capture images in 24 bit sRGB.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the digital camera provides a 24 bit sRGB mode. • Consult product documentation of the digital camera. <p><i>Expected Result:</i></p> <p>The product documentation states that the digital camera is able to capture images in 24 bit sRGB.</p>				

Table 2.11 Test Case ID: TC-AH-FI-DC-002

2.1.4 Test Cases FM AH-FI-DC2

Test Case ID: TC-AH-FI-DC2-001

<i>Scope</i>	Examination of technical specifications of the digital camera used to obtain facial biometrics. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The camera used in the specific application profile is at hand • Product documentation of the camera model is at hand (e.g. data sheet, manual) 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Verify that the sensor of the camera provides a physical resolution of at least 1244 x 1600 pixels.</p> <p>Consult product documentation of the camera.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Verify that the sensor of the camera provides a physical resolution of at least 1244 x 1600 pixels.</p> <p>Consult product documentation of the camera.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Verify that the sensor of the camera provides a physical resolution of at least 1244 x 1600 pixels.</p> <p>Consult product documentation of the camera.</p>				

Test Case ID: TC-AH-FI-DC2-001

Expected Result:

The product documentation states that the physical, native resolution is at least 1244 x 1600 pixels.

2

Description:

Verify that the active camera setting (e.g. configurable via camera firmware) used for the specific application provides an image resolution of at least 1244 x 1600 pixels.

Consult product documentation of the camera or options in the cameras firmware.

Expected Result:

- The setting provides a native image resolution of at least 1244 x 1600 pixels.
- This setting is the active setting for the application profile

Table 2.12 Test Case ID: TC-AH-FI-DC2-001

Test Case ID: TC-AH-FI-DC2-002

Scope Examination of technical specifications of the digital camera used to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.

Preconditions Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the digital camera provides a 24 bit sRGB mode. • Consult product documentation of the digital camera. <p><i>Expected Result:</i></p> <p>The product documentation states that the digital camera is able to capture images in 24 bit sRGB.</p>

Table 2.13 Test Case ID: TC-AH-FI-DC2-002

2.1.5 Test Cases FM AH-FI-EGT

Test Case ID: TC-AH-FI-EGT-001

Scope Examination of technical specifications of the camera system used to obtain digitised facial images in an e-gate scenario.

- Preconditions*
- The camera system used in the specific application profile is at hand and ready for operation.
 - Product documentation of the camera system is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Test Case ID: TC-AH-FI-EGT-001

Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Consult product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The product documentation states the support of capturing facial images of a biometric subject with a body height in the range of 140 cm to 200 cm standing in front of the camera system. • The product documentation states a physical resolution of at least 600x800 pixels without application of upscaling.
	2	<p><i>Description:</i></p> <p>Assess the design of the camera system.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The camera system is designed to be placed in the moving direction of the biometric subject. • The camera system obviously does not require a rotation of the biometric subject for acquisition.

Table 2.15 TC-AH-FI-EGT-001 Description

Table 2.14 Test Case ID: TC-AH-FI-EGT-001

Test Case ID: TC-AH-FI-EGT-002

<i>Scope</i>	Examination of properties of digitised facial images captured by the camera system in an e-gate scenario.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The camera system used in the specific application profile is at hand and ready for operation. • The IUT implements an interface for conformance testing where a single image can be captured. • The IUT is able to return the results for every captured image via the test interface. • One test subject is available to test the IUT's behaviour.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-AH-FI-EGT-002/1

Table 2.17 TC-AH-FI-EGT-002 Test Case Variants

Test Case ID: TC-AH-FI-EGT-002

Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> Position the biometric subject in a distance of 50 cm towards the camera system. Acquire an image with the camera system via the CTS interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>). The CTS verifies that the image returned by the IUT has a resolution of at least 600x800 pixels. The image has sufficient sharpness for visual identification of the subject and does not obviously distort the captured face.
	2	<p><i>Description:</i></p> <ul style="list-style-type: none"> Position the biometric subject in a distance of 100 cm towards the camera system. Acquire an image with the camera system via the CTS interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>). The CTS verifies that the image returned by the IUT has a resolution of at least 600x800 pixels. The image has sufficient sharpness for visual identification of the subject and does not obviously distort the captured face.
	3	<p><i>Description:</i></p> <ul style="list-style-type: none"> Position the biometric subject in a distance of 200 cm towards the camera system. Acquire an image with the camera system via the CTS interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>). The CTS verifies that the image returned by the IUT has a resolution of at least 600x800 pixels. The image has sufficient sharpness for visual identification of the subject and does not obviously distort the captured face.

Table 2.18 TC-AH-FI-EGT-002 Description

Table 2.16 Test Case ID: TC-AH-FI-EGT-002

2.1.6 Test Cases FM AH-FI-FBS

Test Case ID: TC-AH-FI-FBS-001

<i>Scope</i>	Examination of capable image resolution of flat bed scanner used to scan photos for enrolment purposes.				
<i>Preconditions</i>	Product documentation of the scanner model is at hand (e.g. data sheet, manual).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> Verify that the scanner provides a physical resolution of at least 600 dpi. Consult product documentation of the scanner. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> Verify that the scanner provides a physical resolution of at least 600 dpi. Consult product documentation of the scanner.
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> Verify that the scanner provides a physical resolution of at least 600 dpi. Consult product documentation of the scanner. 				

Test Case ID: TC-AH-FI-FBS-001*Expected Result:*

The product documentation states that the physical/native resolution is at least 600 dpi.

Table 2.19 Test Case ID: TC-AH-FI-FBS-001**Test Case ID: TC-AH-FI-FBS-002**

Scope Examination of image quality of flat bed scanner used to scan photos for enrolment purposes

Preconditions

- IUT is running, required modules are loaded.
- The scanner used in the specific application profile is connected.
- As necessary test resources: a photo with at least 36 mm x 45 mm.

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-AH-FI-FBS-002/1

Table 2.21 TC-AH-FI-FBS-002 Test Case Variants*Description*

Step	Description / Expected Result
------	-------------------------------

1

Description:

- A photo is placed on the scan area.
- The IUT is called via the CTS.

Expected Result:

- The image dimension is 622 pixels width and 800 pixels height with a tolerance of +/- 10 pixels.
- The image is of type JPEG.

Table 2.20 Test Case ID: TC-AH-FI-FBS-002

2.1.7 Test Cases FM AH-FI-ICS

Test Case ID: TC-AH-FI-ICS-001

Scope Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the minimum physical resolution of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.

Preconditions Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
------	-------------------------------

1

Description:

- Verify that the sensor of the camera provides a physical resolution of at least 1200 x 1600 pixels without any up-scaling.
- Consult product documentation of the camera.

Expected Result:

The product documentation states that the physical, native resolution is at least 1200 x 1600 pixels.

Table 2.22 Test Case ID: TC-AH-FI-ICS-001

Test Case ID: TC-AH-FI-ICS-002

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the illumination.	
<i>Preconditions</i>	Product documentation of the integrated camera system is at hand (e.g. data sheet, manual).	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the integrated camera system provides diffuse lighting adapting to the environmental light conditions. • Verify that the integrated camera system allows high quality acquisitions independently from the environmental light situation. • Consult product documentation of the integrated camera system. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The product documentation states that the camera system uses diffuse lighting adapting to the environmental light conditions. • The product documentation states that the camera system allows high quality acquisitions independently from the environmental light situation that can usually be found in the environment in question.

Table 2.23 Test Case ID: TC-AH-FI-ICS-002**Test Case ID: TC-AH-FI-ICS-003**

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.	
<i>Preconditions</i>	Product documentation of the camera unit is at hand (e.g. data sheet, manual).	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the integrated camera system provides a 24 bit sRGB mode. • Consult product documentation of the integrated camera system. <p><i>Expected Result:</i></p> <p>The product documentation states that the camera system is able to capture images in 24 bit sRGB.</p>

Table 2.24 Test Case ID: TC-AH-FI-ICS-003**Test Case ID: TC-AH-FI-ICS-004**

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the presence of a digital mirror.	
<i>Preconditions</i>	Product documentation of the camera unit is at hand (e.g. data sheet, manual).	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the integrated camera system provides a digital mirror. • Consult product documentation of the integrated camera system.

Test Case ID: TC-AH-FI-ICS-004*Expected Result:*

The product documentation states that the camera system provides a digital mirror.

Table 2.25 Test Case ID: TC-AH-FI-ICS-004**2.1.8 Test Cases FM AH-FI-ICS2****Test Case ID: TC-AH-FI-ICS2-001**

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the minimum physical resolution of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.	
<i>Preconditions</i>	Product documentation of the camera unit is at hand (e.g. data sheet, manual).	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the sensor of the camera provides a physical resolution of at least 1244 x 1600 pixels without any up-scaling. • Consult product documentation of the camera. <p><i>Expected Result:</i></p> <p>The product documentation states that the physical, native resolution is at least 1244 x 1600 pixels.</p>

Table 2.26 Test Case ID: TC-AH-FI-ICS2-001**Test Case ID: TC-AH-FI-ICS2-002**

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the illumination.	
<i>Preconditions</i>	Product documentation of the integrated camera system is at hand (e.g. data sheet, manual).	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the integrated camera system provides diffuse lighting adapting to the environmental light conditions. • Verify that the integrated camera system allows high quality acquisitions independently from the environmental light situation, provided that the system is set up in an environment that can usually be found in agencies and that offers normal lighting conditions (no direct light from windows etc.). • Consult product documentation of the integrated camera system. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The product documentation states that the camera system uses diffuse lighting adapting to the environmental light conditions. • The product documentation states that the camera system allows high quality acquisitions independently from the environmental light situation that can usually be found in the environment in question.

Table 2.27 Test Case ID: TC-AH-FI-ICS2-002

Test Case ID: TC-AH-FI-ICS2-003

Scope Examination of technical specifications of the integrated camera systems used to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is OPTIONAL for scenarios where only a facial verification is performed.

Preconditions Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> Verify that the integrated camera system provides a 24 bit sRGB mode. Consult product documentation of the integrated camera system. <p><i>Expected Result:</i></p> <p>The product documentation states that the camera system is able to capture images in 24 bit sRGB.</p>

Table 2.28 Test Case ID: TC-AH-FI-ICS2-003

Test Case ID: TC-AH-FI-ICS2-004

Scope Examination of technical specifications of the integrated camera systems used to obtain digitised facial images regarding required range for body height for systems that capture facial images of biometric subjects in a standing position.

Note, that this test case is an alternative for test case TC-AH-FI-ICS2-005. Systems can either use a standing position to obtain facial images (than TC-AH-FI-ICS2-004 is required) or a sitting position (then TC-AH-FI-ICS2-005 is required).

Preconditions Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height at least in the range of 140 cm to 200 cm if standing upright in front of the system.</p>
2	<p><i>Description:</i></p> <p>Position a face in front of the camera system in such a way that the upper edge of the head is at the minimum height of 140 cm. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>
3	<p><i>Description:</i></p> <p>Position a face in front of the camera system in such a way that the upper edge of the head is at the height of 170 cm. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>
4	<p><i>Description:</i></p> <p>Position a face in front of the camera system in such a way that the upper edge of the head is at the maximum height of 200 cm. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>

Table 2.29 Test Case ID: TC-AH-FI-ICS2-004

Test Case ID: TC-AH-FI-ICS2-005

<i>Scope</i>	Examination of technical specifications of the integrated camera systems used to obtain digitised facial images regarding required range for body height for systems that capture facial images of biometric subjects in a sitting position. Note, that this test case is an alternative for test case TC-AH-FI-ICS2-004. Systems can either use a standing position to obtain facial images (than TC-AH-FI-ICS2-004 is required) or a sitting position (then TC-AH-FI-ICS2-005 is required).										
<i>Preconditions</i>	Product documentation of the camera unit is at hand (e.g. data sheet, manual).										
<i>CTS Mode</i>	Not supported										
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height at least in the range of 140 cm to 200 cm if sitting upright in front of the system.</p> </td> </tr> <tr> <td>2</td> <td> <p><i>Description:</i></p> <p>Position a biometric subject with a body height of 140 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p> </td> </tr> <tr> <td>3</td> <td> <p><i>Description:</i></p> <p>Position a biometric subject with a body height of 170 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p> </td> </tr> <tr> <td>4</td> <td> <p><i>Description:</i></p> <p>Position a biometric subject with a body height of 200 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height at least in the range of 140 cm to 200 cm if sitting upright in front of the system.</p>	2	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 140 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>	3	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 170 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>	4	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 200 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>
Step	Description / Expected Result										
1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height at least in the range of 140 cm to 200 cm if sitting upright in front of the system.</p>										
2	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 140 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>										
3	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 170 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>										
4	<p><i>Description:</i></p> <p>Position a biometric subject with a body height of 200 cm looking frontally into the camera and sitting upright in front of the system. Capture a facial image.</p> <p><i>Expected Result:</i></p> <p>The entire face is visible on the image, in the required resolution.</p>										

Table 2.30 Test Case ID: TC-AH-FI-ICS2-005

2.1.9 Test Cases FM AH-FI-SSS

Test Case ID: TC-AH-FI-SSS-001

<i>Scope</i>	Examination of self-service system (SSS) scenarios where a digitised facial image is obtained.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT's SSS is ready for operation. • The SSS implements a graphical user interface and an interface where a single image can be captured. • One test subject is available to test the IUT's behaviour. 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire an image with the camera system of the IUT. • Interact with the graphical user interface of the IUT. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire an image with the camera system of the IUT. • Interact with the graphical user interface of the IUT.
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire an image with the camera system of the IUT. • Interact with the graphical user interface of the IUT. 				

Test Case ID: TC-AH-FI-SSS-001*Expected Result:*

- A facial image is captured.
- During the interaction with the IUT's graphical user interface the biometric subject did not have to rotate his/her head towards the camera system of the IUT for capturing the facial image.

Table 2.31 Test Case ID: TC-AH-FI-SSS-001**2.1.10 Test Cases FM AH-FI-SSS2****Test Case ID: TC-AH-FI-SSS2-001**

Scope Examination of technical specifications of the digital camera used to obtain facial biometrics.

Preconditions

- The camera used in the specific application profile is at hand and ready for operation.
- Product documentation of the camera model is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
------	-------------------------------

1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject with a body height at least in the range of 140 cm to 200 cm either standing or sitting upright in front of the camera.</p>
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Table 2.32 Test Case ID: TC-AH-FI-SSS2-001**Test Case ID: TC-AH-FI-SSS2-002**

Scope Examination of SSS scenarios where a digitised facial image is obtained.

Preconditions

- The IUT's SSS is ready for operation.
- The SSS implements a graphical user interface and an interface where a single image can be captured.
- One test subject is available to test the IUT's behaviour.

CTS Mode Not supported

Description

Step	Description / Expected Result
------	-------------------------------

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire a facial image with the camera system of the IUT. • Interact with the graphical user interface of the IUT. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A facial image is captured. • During the interaction with the IUT's graphical user interface the biometric subject did not have to rotate his/her head towards the camera system of the IUT for capturing the facial image.
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Table 2.33 Test Case ID: TC-AH-FI-SSS2-002**Test Case ID: TC-AH-FI-SSS2-003**

Scope Examination of technical specifications of the digital camera used to obtain facial biometrics.

Test Case ID: TC-AH-FI-SS2-003

Preconditions

- The camera used in the specific application profile is at hand and ready for operation.
- Product documentation of the camera model is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system.</p> <p><i>Expected Result:</i></p> <p>The product documentation states the support of capturing facial images of a biometric subject is at least in the range from at least of 70 cm up to 100 cm. In case the product documentation states that it can operate in a greater range than 100 cm, the exact range is listed. This distances are in general to be understood as the length of the optical path between the forehead and the camera optics, not between the forehead and the front glass of the device. Therefore, this interval must be shifted according to the length of the internal optical path in order to obtain the correct distances from the device.</p>

Table 2.34 Test Case ID: TC-AH-FI-SS2-003

Test Case ID: TC-AH-FI-SS2-004

Scope Examination of image resolution and cropping features of the digital camera used to obtain facial image.

Preconditions

- The camera used in the specific application profile is at hand and ready for operation.
- The IUT implements an interface for conformance testing where a single image can be captured.
- The IUT is able to return the results for every captured image via the test interface.
- One test subject is available to test the IUT's behaviour.

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-AH-FI-SS2-004/1

Table 2.36 TC-AH-FI-SS2-004 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Position the biometric subject looking frontally into the camera at a distance of 70 cm from the camera system. This distance is to be understood as the length of the optical path. • Acquire a facial image with the camera system via the CTS interface. • Verify the image returned by the CTS. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition). • The CTS verifies that the image returned by the IUT has at least a resolution of 1244 x 1600 pixels and the colour space is 24 bit sRGB. • The CTS shows a facial image according to the definition of "full frontal" (see [ISO_FACE]).

Test Case ID: TC-AH-FI-SSS2-004

2

Description:

- Position the biometric subject looking frontally into the camera at a distance of 100 cm from the camera system. This distance is to be understood as the length of the optical path.
- Acquire a facial image with the camera system via the CTS interface.
- Verify the image returned by the CTS.

Expected Result:

- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).
- The CTS verifies that the image returned by the IUT has at least a resolution of 1244 x 1600 pixels and the colour space is 24 bit sRGB.
- The CTS shows a facial image according to the definition of "full frontal" (see [ISO_FACE]).

3

Description:

- Position the biometric subject looking frontally into the camera at the maximum possible distance (according to the vendor/document sheet) from the camera system.
- Acquire a facial image with the camera system via the CTS interface.
- Verify the image returned by the CTS.

Expected Result:

- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).
- The CTS verifies that the image returned by the IUT has at least a resolution of 1244 x 1600 pixels and the colour space is 24 bit sRGB.
- The CTS shows a facial image according to the definition of "full frontal" (see [ISO_FACE]).

Table 2.35 Test Case ID: TC-AH-FI-SSS2-004

2.1.11 Test Cases FM AH-FP-ALL

Test Case ID: TC-AH-FP-ALL-001

Scope Check of the image sensors FBI certification.

Preconditions The vendor of the image sensor provides the FBI certificate of the successful FBI certification.

CTS Mode Not supported

Description

Step	Description / Expected Result
------	-------------------------------

1

Description:

Examination of the FBI certificate provided by the vendor.

Expected Result:

In case of multi finger scanners:

- The FBI certificate shows, that the device under test is certified according to [EBTS/F].
- The successful FBI certification is not older than 10 years.

In case of single finger scanners:

- The FBI certificate shows, that the device under test is certified according to [EBTS/F] or [PIV].
- The successful FBI certification is not older than 10 years.

Table 2.37 Test Case ID: TC-AH-FP-ALL-001

2.1.12 Test Cases FM AH-FP-OPT

Test Case ID: TC-AH-FP-OPT-001

Scope Test of image sensor linearity.

Preconditions

- The scanner is connected.
- The scanner software is set to output unprocessed images.
- Captured images can be saved for subsequent evaluation.
- Depending on the following conditions method A, B, C or D is chosen for the test:
 - Method A: It is possible to control the integration time of the scanner's image sensor.
 - Method B: It is possible to control the intensity of the scanner's illumination.
 - Method C: It is only possible to turn the scanner's illumination on and off.
 - Method D: Neither of the above can be controlled.
- Test resources:
 - Method A and B: A diffuse reflecting uniform white target (e.g. Munsell N9).
 - Method C: An external extended uniform light source (e.g. LED backlight or similar).
 - Method B and C: Measurement equipment for measuring the luminance of the illumination.
 - Method D: A diffuse reflecting target with a grey scale step tablet or a set of uniform neutral grey targets cards with various known reflectance.
 - Image processing software to determine the average grey value in a region of interest in the image.

CTS Mode

Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Method A: The white target is placed on the scanner platen. The scanner's illumination is turned on and left unchanged during the test. Multiple images are taken while varying the integration time of the image sensor. The setting of the integration time is recorded with each image. • Method B: The white target is placed on the scanner platen. Multiple images are taken while varying the intensity of the illumination of the scanner. The luminance of the illumination is monitored at the same time and recorded with each image. • Method C: The scanner's illumination is turned off. The external light source is placed on the scanner platen. Multiple images are taken while varying the intensity of the external illumination. The luminance of the external illumination is monitored at the same time and recorded with each image. • Method D: The grey scale target is placed on the scanner platen and an image is taken. In case of a set of uniform targets images of each target are taken sequentially and the reflectance of the target is recorded with each image. • All methods: At least nine images/individual grey values are required that substantially cover the scanners dynamic range. <p><i>Expected Result:</i></p> <p>Set of images with a uniform area covered by the target or a single image of a target with a grey scale step tablet.</p>
2	<p><i>Description:</i></p> <p>For each of the images the average grey value is determined in the area covered by the colour test card. The average grey value is plotted against the previously recorded integration time (Method A), luminance (Method B, C) or reflectance (Method D).</p>

Test Case ID: TC-AH-FP-OPT-001

Expected Result:

The resulting plot should be close to a linear function.

A linear regression is performed over the value pairs (integration time, average grey value),(luminance, average grey value) or (reflectance, grey value). The difference between the average grey value and the grey value from regression is calculated for each measurement.

None of the calculated differences SHALL exceed 7.65 grey levels.

3

Description:

A linear regression is performed over the value pairs (integration time, average grey value),(luminance, average grey value) or (reflectance, grey value). The difference between the average grey value and the grey value from regression is calculated for each measurement.

Expected Result:

None of the calculated differences SHALL exceed 7.65 grey levels.

Table 2.38 Test Case ID: TC-AH-FP-OPT-001

Test Case ID: TC-AH-FP-OPT-002

Scope Test of scanner resolution and geometrical accuracy.

- Preconditions*
- The scanner is connected.
 - The scanner software is set to output unprocessed images.
 - Captured images can be saved for subsequent evaluation.
 - Test resources:
 - A Ronchi bar pattern target, that consists of an equal-width bar and space square wave pattern at 1.0 cy/mm, preferably on a flexible, diffuse white reflecting substrate. The target pattern SHALL cover at least 70% of the scanner's capture area.
 - The test software WinGeo (IQS Test Tools CD).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>The target is placed on the scanner platen and images are taken with the lines of the Ronchi pattern parallel to the pixel columns (vertical bars) and rows (horizontal bars) of the image sensor, respectively. A flexible target has to be pressed against the scanner platen to make sure the target is in contact with the platen over the entire pattern area. To discern properties of the scanner and the target the procedure may be repeated with the target being rotated by 180 degrees. If accuracy failures in the images remain at the same location they are most probably due to the scanner.</p> <p><i>Expected Result:</i></p> <p>Set of images with the lines of the Ronchi pattern in vertical and horizontal direction, respectively.</p>
2	<p><i>Description:</i></p> <p>The obtained image files are converted to raw image data (pixel grey values without header) and are processed with the software WinGeo. The program calculates the 1-bar and 6-bar distances of the pattern in the image (across-bar accuracy) as well as the along-bar accuracy. Also the resolution is calculated from the 6-bar distances.</p>

Test Case ID: TC-AH-FP-OPT-002

Expected Result:

- Resolution: The scanner's output resolution in both sensor detector row and column directions SHALL be $(R \pm 0.01 R)$, with R being 500 pixels per inch or 1000 pixels per inch.
 - Across-bar accuracy: The difference D between the distance of the bars on the target and the corresponding distance measured in the image SHALL not exceed in at least 99% of the tested cases in horizontal and vertical direction, respectively:
 - For 500-ppi scanner:
 - $D \leq 0.0007$, for $0.00 < X \leq 0.07$
 - $D \leq 0.01 X$, for $0.07 \leq X \leq 1.50$
 - For 1,000-ppi scanner:
 - $D \leq 0.0005$, for $0.00 < X \leq 0.07$
 - $D \leq 0.0071 X$, for $0.07 \leq X \leq 1.5$
- where:
- $D = |Y - X|$
- X = actual target distance
- Y = measured image distance
- D, X, Y are in inches.
- Along-bar accuracy: In both vertical bar and horizontal bar orientations, the maximum difference in the horizontal or vertical direction, respectively, between the locations of any two points within a 1.5-inch segment of a given bar image SHALL not exceed 0.016 inches for at least 99.0 percent of the tested cases.

Table 2.39 Test Case ID: TC-AH-FP-OPT-002

Test Case ID: TC-AH-FP-OPT-003

<i>Scope</i>	Test of spatial frequency response.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The scanner is connected. • The scanner software is set to output unprocessed images. • Captured images can be saved for evaluation. • Test resources: <ul style="list-style-type: none"> • A test chart containing Ronchi test patterns meeting or exceeding the minimum requirements given in ▶Table 2.41 for 500 ppi scanners or in ▶Table 2.42 for 1000 ppi scanners. The target must also contain large black and white patches for normalizing the contrast. Preferably the target should consist of dark patterns on a flexible, diffuse white reflecting substrate material. The material SHALL be optically opaque and exhibit no significant volume scattering as this degrades the contrast of the patterns. Rigid materials should not be used, if possible, to avoid damage to the image sensor. • A file describing the type, position and size of the different patterns on the test chart. This is required for processing the captured images with WinMTF. • The test software WinMTF (IQS Test Tools CD). 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #333; color: white;"> <th style="width: 15%;">Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Step	Description / Expected Result		
Step	Description / Expected Result				

Test Case ID: TC-AH-FP-OPT-003

- 1 *Description:*
- The target is placed on the scanner platen and images are taken with the lines of the Ronchi pattern parallel to the pixel columns (vertical bars) and rows (horizontal bars) of the image sensor, respectively. A flexible target has to be pressed against the scanner platen to make sure the target is in contact with the platen over the entire pattern area. If the target pattern covers less than 25% of the scanners capture area, the procedure is applied to the right and the left half of the capture area, respectively. The bars of the Ronchi patterns have to be aligned with the pixel rows and columns to an angle less than 0.5°. If the images from the scanner are inverted they have to be inverted back to show dark patterns on a bright background.
- Expected Result:*
- Set of images with the bars of the Ronchi pattern in vertical and horizontal direction, showing dark patterns on a bright background.
- 2 *Description:*
- The resulting images files are converted to TIFF format and are processed with the tool WinMTF. This program determines the modulation in each of the Ronchi test patterns. These modulation values are absolute with respect to the dynamic range of the image and do not represent the contrast transfer function (CTF).
- Expected Result:*
- Absolute modulation values for each of the Ronchi patterns on the test chart.
- 3 *Description:*
- The absolute modulation values have to be normalized by the modulation of the large black and white patches on the test chart, representing a spatial frequency of approximately zero cycles per millimetre. The average grey level in the black and white patches is calculated and the modulation is calculated as follows: $M_0 = \frac{G_{white} - G_{black}}{G_{white} + G_{black}}$
- with
- M_0 : Modulation for 0 cy/mm
 - G_{white} : average grey level in the white patch
 - G_{black} : average grey level in the black patch
- Having determined M_0 the value of the CTF can be calculated from the modulation of the Ronchi pattern: $CTF(R) = \frac{M(R)}{M_0}$
- with $M(R)$ Modulation at spatial frequency R
- Expected Result:*
- The values of the CTF for each of the spatial frequencies specified in ▶Table 2.41 (500 ppi scanners) or ▶Table 2.42 (1000 ppi scanners) must be greater than the corresponding minimum CTF and less than the corresponding maximum CTF specified in the same table.
 - The resulting image SHALL be free from significant effects of aliasing.

Table 2.40 Test Case ID: TC-AH-FP-OPT-003

Spatial Frequency R [cycles/mm]	R/Rnyquist 500ppi	Min. Number of Bars	Bar width [mm]	Min. Length of Bars [mm]	Min. CTF 500ppi	Max. CTF
<0,3	3%	1	>1.7	1.7	-	-
1	10%	4	0.500	2.5	0.948	1.05
2	20%	5	0.250	2.5	0.869	1.05

Spatial Frequency R [cycles/mm]	R/Rnyquist 500ppi	Min. Number of Bars	Bar width [mm]	Min. Length of Bars [mm]	Min. CTF 500ppi	Max. CTF
3	30%	5	0.167	2.5	0.791	1.05
4	40%	5	0.125	2.5	0.713	1.05
5	50%	10	0.100	2.5	0.636	1.05
6	60%	10	0.083	2.5	0.559	1.05
7	70%	10	0.071	2.5	0.483	1.05
8	80%	10	0.063	2.5	0.408	1.05
9	90%	10	0.056	2.5	0.333	1.05
10	100%	10	0.050	2.5	0.259	1.05

Table 2.41 Requirements for CTF test charts for 500 ppi scanners

Spatial Frequency R [cycles/mm]	R/Rnyquist 500ppi	Min. Number of Bars	Bar width [mm]	Min. Length of Bars [mm]	Min. CTF 500ppi	Max. CTF
<0,3	2%	1	>1.7	1.7	-	-
1	5%	4	0.500	2.5	0.957	1.05
2	10%	4	0.250	2.5	0.904	1.05
3	15%	5	0.167	2.5	0.854	1.05
4	20%	5	0.125	2.5	0.805	1.05
5	25%	5	0.100	2.5	0.760	1.05
6	30%	5	0.083	2.5	0.716	1.05
7	35%	5	0.071	2.5	0.675	1.05
8	40%	5	0.063	2.5	0.636	1.05
9	45%	10	0.056	2.5	0.598	1.05
10	50%	10	0.050	2.5	0.563	1.05
12	60%	10	0.042	2.5	0.497	1.05
14	70%	10	0.036	2.5	0.437	1.05
16	80%	10	0.031	2.5	0.382	1.05
18	90%	10	0.028	2.5	0.332	1.05
20	100%	10	0.025	2.5	0.284	1.05

Table 2.42 Requirements for CTF test charts for 1000 ppi scanners

Test Case ID: TC-AH-FP-OPT-004

<i>Scope</i>	Test of signal to noise ratio and grey level uniformity.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The scanner is connected. • The scanner software is set to output unprocessed images. • Captured images can be saved for evaluation. • Test resources: <ul style="list-style-type: none"> • A uniform diffuse reflecting neutral grey target of high reflectance that covers the scanner's entire capture area (e.g Munsell N9). • A uniform diffuse reflecting neutral grey target of low reflectance that covers the scanner's entire capture area (e.g Munsell N2). • The test software signal-to-noise ratio (SNR)(IQS Test Tools CD).

Test Case ID: TC-AH-FP-OPT-004

CTS Mode Not supported

Description

Step Description / Expected Result

1

Description:

The black target is placed on the scanner platen and an image is taken. After that the procedure is repeated with the white target. The definition of “black image” and “white image” for the subsequent analyses depends on the grey value that the target would produce in the final fingerprint image. If high reflectance produces a high grey value in the final fingerprint image then the image obtained with the high reflectance target is considered the “white image”. If low reflectance produces a high grey value (inverting behaviour) then the image obtained with the low reflectance target is considered the “white image”. The other image is then considered the “black image”.

Expected Result:

- A black image with the average grey value in the image being at least 4 grey levels above the scanner’s minimum output grey level.
- A white image with the average grey value in the image being at least 4 grey levels below the scanner’s maximum output grey level.

2

Description:

The black and white images are converted to raw image data (pixel grey values without header) and are processed with the software SNR. The program divides the images in blocks of 6.35 mm x 6.35 mm and determines the average grey level, the standard deviation, the grey level averages in the columns and rows, respectively, and the number of pixels with a higher-than-allowed difference of the grey level from the average in each of the blocks. With these quantities the required tests regarding signal-noise-ratio and grey level uniformity are performed.

Expected Result:

- Signal to noise ratio: Signal is defined as the difference between the average grey levels of corresponding blocks in the white and the black image. Noise is defined as the standard deviation of the grey levels in each block of the white and black image, respectively. The signal-noise ratio is calculated as

$$\text{with } SNR_{black} = \frac{\overline{G}_{white} - \overline{G}_{black}}{\sigma_{black}}, SNR_{white} = \frac{\overline{G}_{white} - \overline{G}_{black}}{\sigma_{white}}$$

$\overline{G}_{white}, \overline{G}_{black}$: average grey level in a block of the black and white image, respectively

$\sigma_{white}, \sigma_{black}$: standard deviation of the grey levels in a block of the black and white image, respectively

The signal to noise ratio SHALL exceed 125 for at least 97% of the tested blocks in both the black and the white image.

- Grey level uniformity requirement #1 (adjacent row, column uniformity): At least 99% of the average grey levels between every two adjacent 6.35 mm long rows and 99% between every two adjacent 6.35 mm long columns, SHALL not differ by more than 1.0 grey levels in the black and SHALL not differ by more than 2.0 grey levels in the white image.
- Grey level uniformity requirement #2 (pixel to pixel uniformity): For at least 99.9% of all pixels within every independent 6.35 mm x 6.35 mm block no individual pixel’s grey level SHALL vary from the average by more than 8.0 grey levels in the black image, and SHALL not vary from the average by more than 22.0 grey levels in the white image.
- Grey level uniformity requirement #3 (small area uniformity): For every two independent 6.35 mm x 6.35 mm blocks the average grey levels of the two blocks SHALL not differ by more than 3.0 grey levels in the black image, and SHALL not differ by more than 12.0 grey levels in the white image.

Table 2.43 Test Case ID: TC-AH-FP-OPT-004

Test Case ID: TC-AH-FP-OPT-005

Scope	Test of fingerprint image quality.						
Preconditions	<ul style="list-style-type: none"> The scanner is connected. The scanner software is set to output completely processed fingerprint images. Captured images can be saved for evaluation. Test resources: <ul style="list-style-type: none"> 10 different test persons. Image processing software for histogram analysis. 						
CTS Mode	Not supported						
Description	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Images of every finger of each test person are taken with the scanner. If the scanner is capable of capturing 4-finger images additional 4-finger images of each hand are taken.</p> <p><i>Expected Result:</i></p> <p>Images of every finger of each test person. In case of a 4-finger scanner also 4-finger images of every hand of each test person.</p> </td> </tr> <tr> <td>2</td> <td> <p><i>Description:</i></p> <p>For each image a histogram of the grey levels is produced. The histogram is tested for gaps and the number of grey levels with at least 5 counts in the image are counted.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> The number of grey levels present with at least 5 pixels in the image SHALL be at least 128 for at least 99% of the tested images. The number of grey levels present with at least 5 pixels in the image SHALL be at least 200 for at least 80% of the tested images. There SHALL be no gaps in the histogram. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Images of every finger of each test person are taken with the scanner. If the scanner is capable of capturing 4-finger images additional 4-finger images of each hand are taken.</p> <p><i>Expected Result:</i></p> <p>Images of every finger of each test person. In case of a 4-finger scanner also 4-finger images of every hand of each test person.</p>	2	<p><i>Description:</i></p> <p>For each image a histogram of the grey levels is produced. The histogram is tested for gaps and the number of grey levels with at least 5 counts in the image are counted.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> The number of grey levels present with at least 5 pixels in the image SHALL be at least 128 for at least 99% of the tested images. The number of grey levels present with at least 5 pixels in the image SHALL be at least 200 for at least 80% of the tested images. There SHALL be no gaps in the histogram.
Step	Description / Expected Result						
1	<p><i>Description:</i></p> <p>Images of every finger of each test person are taken with the scanner. If the scanner is capable of capturing 4-finger images additional 4-finger images of each hand are taken.</p> <p><i>Expected Result:</i></p> <p>Images of every finger of each test person. In case of a 4-finger scanner also 4-finger images of every hand of each test person.</p>						
2	<p><i>Description:</i></p> <p>For each image a histogram of the grey levels is produced. The histogram is tested for gaps and the number of grey levels with at least 5 counts in the image are counted.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> The number of grey levels present with at least 5 pixels in the image SHALL be at least 128 for at least 99% of the tested images. The number of grey levels present with at least 5 pixels in the image SHALL be at least 200 for at least 80% of the tested images. There SHALL be no gaps in the histogram. 						

Table 2.44 Test Case ID: TC-AH-FP-OPT-005

2.1.13 Test Cases FM AH-FP-SSS

Test Case ID: TC-AH-FP-SSS-001

Scope	Examination of SSS scenarios where digitised fingerprint images are obtained.
Preconditions	<ul style="list-style-type: none"> The IUT's SSS is ready for operation. The SSS implements a graphical user interface and an interface where fingerprint images can be captured. Two test subjects are available to test the IUT's behaviour.
CTS Mode	<ul style="list-style-type: none"> interactive no provision of pre-defined input data HTTP method: GET test case variants:

/TR03122/TC-AH-FP-SSS-001/1

Table 2.46 TC-AH-FP-SSS-001 Test Case Variants

Description	Step	Description / Expected Result
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Test Case ID: TC-AH-FP-SSS-001

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire fingerprint images with the acquisition system of the IUT using the right hand. • Interact with the graphical user interface of the IUT. <p><i>Expected Result:</i></p> <p>Fingerprint images of the right hand are captured.</p>
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT. • Acquire fingerprint images with the acquisition system of the IUT using the left hand. • Interact with the graphical user interface of the IUT. <p><i>Expected Result:</i></p> <p>Fingerprint images of the left hand are captured.</p>
3	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The biometric subject initiates the SSS process of the IUT with another subject being present within the reach of the fingerprint acquisition system of the SSS. • Acquire fingerprint images with the acquisition system of the IUT using the left or right hand. • Interact with the graphical user interface of the IUT. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • During the fingerprint acquisition process multiple persons are detected by the SSS. • The acceptance conditions are not met, i.e. the total result of the acquisition is negative. • The multiple person detection result is cached locally on the SSS.

Table 2.45 Test Case ID: TC-AH-FP-SSS-001

2.2 Test Cases Acquisition Software

2.2.1 Test Cases FM AS-FI-DC

Test Case ID: TC-AS-FI-DC-001

<i>Scope</i>	Examination of the software module used for acquisition of digitised facial images
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • The digital camera used in the specific application scenario is connected
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: GET • test case variants:

/TR03122/TC-AS-FI-DC-001/1

Table 2.48 TC-AS-FI-DC-001 Test Case Variants

Description

Step	Description / Expected Result
------	-------------------------------

Test Case ID: TC-AS-FI-DC-001

1

Description:

Check proper data encoding, resolution and format of the returned image

- Initiate test case by calling the IUT via the test interface
- Capture an image with the camera, examine the digitised image data
- Check the resulting image for visible compression artefacts

Expected Result:

- As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition and bio:Records)
- The image is at least of resolution 1200 x 1600 pixels with an inter eye distance of at least 120 pixels and stored in colour (24 bit sRGB). Note, the latter requirement is not mandatory for scenarios where only a facial verification is performed.
- Regarding compression artefacts:
 - For digital cameras, no compression artefacts are visible in the resulting image.
 - For webcams, no severe compression artefacts are visible in the resulting image.

Table 2.47 Test Case ID: TC-AS-FI-DC-001

2.2.2 Test Cases FM AS-FI-DC2

Test Case ID: TC-AS-FI-DC2-001*Scope*

Examination of the software module used for acquisition of digitised facial images

Preconditions

- IUT is running, required modules are loaded
- The digital camera used in the specific application scenario is connected

CTS Mode

- interactive
- no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")
- HTTP method: GET
- test case variants:

/TR03122/TC-AS-FI-DC2-001/1

Table 2.50 TC-AS-FI-DC2-001 Test Case Variants*Description***Step****Description / Expected Result**

1

Description:

Check proper data encoding, resolution and format of the returned image

- Initiate test case by calling the IUT via the test interface
- Capture an image with the camera, examine the digitised image data
- Check the resulting image for visible compression artefacts

Test Case ID: TC-AS-FI-DC2-001*Expected Result:*

- As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition and bio:Records)
- The image is at least of resolution 1244 x 1600 pixels with an inter eye distance of at least 300 pixels and stored in colour (24 bit sRGB).
- There are no visible compression artefacts in the resulting image

Table 2.49 Test Case ID: TC-AS-FI-DC2-001

2.2.3 Test Cases FM AS-FI-FBS

Test Case ID: TC-AS-FI-FBS-001

<i>Scope</i>	Examination of acquisition software for flat bed scanners that are used for the provisioning of digitised application forms. This test case covers the image format used by the acquisition software of the scanner system.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A document scanner is connected • As test resource: a application form preferable for German Identity Document (GID)
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision as JPEG or JPEG2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: GET • test case variants:

/TR03122/TC-AS-FI-FBS-001/1

Table 2.52 TC-AS-FI-FBS-001 Test Case Variants

<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <i>Description:</i> <ul style="list-style-type: none"> • Initiate the test case via the test interface. • Verfiy compression of file with JPEG decoder/viewer. <i>Expected Result:</i> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded image is returned via the test interface. • The image is provided in JPEG. • The image is provided without any prior or further compression in JPEG, meaning that, apart from the compression of JPEG itself, no further compression is applied. The facial image is provided with the least compression possible. • The image can be displayed. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<i>Description:</i> <ul style="list-style-type: none"> • Initiate the test case via the test interface. • Verfiy compression of file with JPEG decoder/viewer. <i>Expected Result:</i> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded image is returned via the test interface. • The image is provided in JPEG. • The image is provided without any prior or further compression in JPEG, meaning that, apart from the compression of JPEG itself, no further compression is applied. The facial image is provided with the least compression possible. • The image can be displayed.
Step	Description / Expected Result				
1	<i>Description:</i> <ul style="list-style-type: none"> • Initiate the test case via the test interface. • Verfiy compression of file with JPEG decoder/viewer. <i>Expected Result:</i> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded image is returned via the test interface. • The image is provided in JPEG. • The image is provided without any prior or further compression in JPEG, meaning that, apart from the compression of JPEG itself, no further compression is applied. The facial image is provided with the least compression possible. • The image can be displayed. 				

Table 2.51 Test Case ID: TC-AS-FI-FBS-001

2.2.4 Test Cases FM AS-FI-ICS

Test Case ID: TC-AS-FI-ICS-001

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the image formats supported by the acquisition software of the camera system.
<i>Preconditions</i>	Product documentation of the utilised camera system is at hand (e.g. data sheet, manual).
<i>CTS Mode</i>	Not supported

Test Case ID: TC-AS-FI-ICS-001

Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system and check the supported image formats.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the software provides raw uncompressed image data e.g. YUV422 or sRGB or the software provides a lossless image container format (e.g. BMP, TIFF).</p>

Table 2.53 Test Case ID: TC-AS-FI-ICS-001**Test Case ID: TC-AS-FI-ICS-002**

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the minimum physical resolution of the captured facial image. Note, this requirement is not MANDATORY for scenarios where only a facial verification is performed.	
<i>Preconditions</i>	<ul style="list-style-type: none"> • The integrated camera system used in the specific application profile is connected and the system is ready for capturing. • Product documentation of the camera unit is at hand (e.g. data sheet, manual). 	
<i>CTS Mode</i>	Not supported	
Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active camera setting (e.g. configurable via camera firmware) used for the specific application provides an image resolution of at least 1200 x 1600 pixels without any up-scaling. • Consult product documentation of the camera and options in the cameras firmware. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The setting provides a native image resolution of at least 1200 x 1600 pixels. • This setting is the active setting for the application profile.

Table 2.54 Test Case ID: TC-AS-FI-ICS-002**Test Case ID: TC-AS-FI-ICS-003**

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the illumination.	
<i>Preconditions</i>	<ul style="list-style-type: none"> • The integrated camera system used in the specific application profile is connected and the system is ready for capturing. • Product documentation of the integrated camera system is at hand (e.g. data sheet, manual). 	
<i>CTS Mode</i>	Not supported	
Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides diffuse lighting adapting to the environmental light conditions. • Consult product documentation of the integrated camera system and options in the firmware.

Test Case ID: TC-AS-FI-ICS-003*Expected Result:*

- The setting provides diffuse lighting adapting to the environmental light conditions.
- The setting is the active setting for the application profile.

Table 2.55 Test Case ID: TC-AS-FI-ICS-003**Test Case ID: TC-AS-FI-ICS-004**

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is not MANDATORY for scenarios where only a facial verification is performed.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The integrated camera system used in the specific application profile is connected and the system is ready for capturing. • Product documentation of the camera unit is at hand (e.g. data sheet, manual). 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides the ability to capture images in colour. • Consult product documentation of the integrated camera system and options in the firmware. <p><i>Expected Result:</i></p> <p>The setting provides the ability to capture images in colour (24 bit sRGB).</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides the ability to capture images in colour. • Consult product documentation of the integrated camera system and options in the firmware. <p><i>Expected Result:</i></p> <p>The setting provides the ability to capture images in colour (24 bit sRGB).</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides the ability to capture images in colour. • Consult product documentation of the integrated camera system and options in the firmware. <p><i>Expected Result:</i></p> <p>The setting provides the ability to capture images in colour (24 bit sRGB).</p>				

Table 2.56 Test Case ID: TC-AS-FI-ICS-004

2.2.5 Test Cases FM AS-FI-ICS2

Test Case ID: TC-AS-FI-ICS2-001

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the image formats supported by the acquisition software of the camera system.				
<i>Preconditions</i>	Product documentation of the utilised camera system is at hand (e.g. data sheet, manual).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Consult the product documentation of the camera system and check the supported image formats.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the software provides raw uncompressed image data e.g. YUV422 or sRGB or the software provides a lossless image container format (e.g. BMP, TIFF).</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system and check the supported image formats.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the software provides raw uncompressed image data e.g. YUV422 or sRGB or the software provides a lossless image container format (e.g. BMP, TIFF).</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Consult the product documentation of the camera system and check the supported image formats.</p> <p><i>Expected Result:</i></p> <p>The product documentation states that the software provides raw uncompressed image data e.g. YUV422 or sRGB or the software provides a lossless image container format (e.g. BMP, TIFF).</p>				

Table 2.57 Test Case ID: TC-AS-FI-ICS2-001**Test Case ID: TC-AS-FI-ICS2-002**

<i>Scope</i>	Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the minimum physical resolution of the captured facial image. Note, this requirement is not MANDATORY for scenarios where only a facial verification is performed.
--------------	--

Test Case ID: TC-AS-FI-ICS2-002

- Preconditions*
- The integrated camera system used in the specific application profile is connected and the system is ready for capturing.
 - Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active camera setting (e.g. configurable via camera firmware) used for the specific application provides an image resolution of at least 1244 x 1600 pixels without any up-scaling. • Consult product documentation of the camera and options in the cameras firmware. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The setting provides a native image resolution of at least 1244 x 1600 pixels. • This setting is the active setting for the application profile.

Table 2.58 Test Case ID: TC-AS-FI-ICS2-002

Test Case ID: TC-AS-FI-ICS2-003

Scope Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the illumination.

- Preconditions*
- The integrated camera system used in the specific application profile is connected and the system is ready for capturing.
 - Product documentation of the integrated camera system is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides diffuse lighting adapting to the environmental light conditions. • Consult product documentation of the integrated camera system and options in the firmware. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The setting provides diffuse lighting adapting to the environmental light conditions. • The setting is the active setting for the application profile.

Table 2.59 Test Case ID: TC-AS-FI-ICS2-003

Test Case ID: TC-AS-FI-ICS2-004

Scope Examination of technical specifications for acquisition software used for integrated camera systems in order to obtain digitised facial images. This test case covers the colour space of the captured facial image. Note, this requirement is not MANDATORY for scenarios where only a facial verification is performed.

- Preconditions*
- The integrated camera system used in the specific application profile is connected and the system is ready for capturing.
 - Product documentation of the camera unit is at hand (e.g. data sheet, manual).

CTS Mode Not supported

Description

Step	Description / Expected Result
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Test Case ID: TC-AS-FI-ICS2-004

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify that the active setting of the integrated camera system used for the specific application provides the ability to capture images in colour. • Consult product documentation of the integrated camera system and options in the firmware. <p><i>Expected Result:</i></p> <p>The setting provides the ability to capture images in colour (24 bit sRGB).</p>
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Table 2.60 Test Case ID: TC-AS-FI-ICS2-004**Test Case ID: TC-AS-FI-ICS2-005**

<i>Scope</i>	Examination of the software module used for acquisition of digitised facial images				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The integrated camera system used in the specific application profile is connected and the system is ready for capturing. • Product documentation of the camera unit is at hand (e.g. data sheet, manual). 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td> <p><i>Description:</i></p> <p>Check proper data encoding, resolution and format of the returned image</p> <ul style="list-style-type: none"> • Capture an image with the camera, examine the digitised image data • Check the resulting image for visible compression artefacts <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The image is at least of resolution 1244 x 1600 pixels with an inter eye distance of at least 300 pixels and stored in colour (24 bit sRGB). • There are no visible compression artefacts in the resulting image </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Check proper data encoding, resolution and format of the returned image</p> <ul style="list-style-type: none"> • Capture an image with the camera, examine the digitised image data • Check the resulting image for visible compression artefacts <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The image is at least of resolution 1244 x 1600 pixels with an inter eye distance of at least 300 pixels and stored in colour (24 bit sRGB). • There are no visible compression artefacts in the resulting image
Step	Description / Expected Result				
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Table 2.61 Test Case ID: TC-AS-FI-ICS2-005**Test Case ID: TC-AS-FI-ICS2-006**

<i>Scope</i>	Examination of the software module used for acquisition of digitised facial images						
<i>Preconditions</i>	<ul style="list-style-type: none"> • The integrated camera system used in the specific application profile is connected and the system is ready for capturing. • Product documentation of the camera unit is at hand (e.g. data sheet, manual). 						
<i>CTS Mode</i>	Not supported						
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td> <p><i>Description:</i></p> <p>Check proper uniform background in case the background meets the requirements of [ISO_FACE] and [ICAO_TR_Portrait_Quality].</p> <p>Capture an image with the camera, examine the digitised image data.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • There are no visible background artefacts in the resulting image. • There is a uniform background according to [ISO_FACE] and [ICAO_TR_Portrait_Quality]. </td> </tr> <tr> <td style="text-align: center;">2</td> <td> <p><i>Description:</i></p> <p>Check proper uniform background in case the background was eliminated and replaced.</p> <p>Capture an image with the camera, examine the digitised image data.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Check proper uniform background in case the background meets the requirements of [ISO_FACE] and [ICAO_TR_Portrait_Quality].</p> <p>Capture an image with the camera, examine the digitised image data.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • There are no visible background artefacts in the resulting image. • There is a uniform background according to [ISO_FACE] and [ICAO_TR_Portrait_Quality]. 	2	<p><i>Description:</i></p> <p>Check proper uniform background in case the background was eliminated and replaced.</p> <p>Capture an image with the camera, examine the digitised image data.</p>
Step	Description / Expected Result						
1	<p><i>Description:</i></p> <p>Check proper uniform background in case the background meets the requirements of [ISO_FACE] and [ICAO_TR_Portrait_Quality].</p> <p>Capture an image with the camera, examine the digitised image data.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • There are no visible background artefacts in the resulting image. • There is a uniform background according to [ISO_FACE] and [ICAO_TR_Portrait_Quality]. 						
2	<p><i>Description:</i></p> <p>Check proper uniform background in case the background was eliminated and replaced.</p> <p>Capture an image with the camera, examine the digitised image data.</p>						

Test Case ID: TC-AS-FI-ICS2-006*Expected Result:*

- There are no visible background artefacts in the resulting image.
- The face, hair and shoulders are not changed (includes cutting off).
- There is a uniform grey background (i.e. R=G=B) and the grey is between #A1A1A1 and #E1E1E1.

Table 2.62 Test Case ID: TC-AS-FI-ICS2-006**Test Case ID: TC-AS-FI-ICS2-007**

Scope Examination of the software module used for acquisition of digitised facial images with focus on the active camera settings.

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - An Integrated Camera System (ICS) is connected
 - IUT is configured to perform the acquisition of a facial image.
 - A testperson is available to test the IUT's behaviour.

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-AS-FI-ICS2-007/1

Table 2.64 TC-AS-FI-ICS2-007 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Capture one image of the testperson with the ICS using the IUT. Examination of the acquired Image. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT delivers a response that is conformant to the schema file trbio5v1.xsd. • The response contains the correct number of elements based on the XPath expression <code>./bio:Records/bio:BinaryRecord[@type='jpeg']</code>. Exactly 1 element is expected in accordance to the acquisition process. • The data embedded in the element <code>./bio:Records/bio:BinaryRecord[@type='jpeg']</code> of the response XML is JPEG. • The image captured by the ICS has a resolution of at least 1244 x 1600. • The image has a colour space of 24bit RGB or 8 bit Greyscale • The image depicts the testperson in the moment of the acquisition. • The image does not contain compression artefacts.

Table 2.63 Test Case ID: TC-AS-FI-ICS2-007**Test Case ID: TC-AS-FI-ICS2-008**

Scope Examination of the software module used for acquisition of digitised facial images with focus on the background elimination.

Test Case ID: TC-AS-FI-ICS2-008*Preconditions*

- The IUT is in operation, required modules are loaded.
- A groundtruth database is at hand.
- The facial images in the database are either 24bit RGB or 8bit grayscale.
- A set of metrics is given to evaluate the quality of the segmentation.
- The following conditions apply regarding the database:
 - The groundtruth database contains pairs of images in format JPEG
 - Each pair consists of a facial image with non-uniform background and an image with the segmentation result, i.e. an image of the same dimensions as the facial image with pixels of either black or white. A pixel in the segmentation result is black iff the corresponding pixel in the facial image is a background-pixel.
 - The images in the database have dimensions of 1600*1244.
 - The facial images in the database are either 24bit RGB or 8bit grayscale.

CTS Mode

- automatic
- no provision of pre-defined input data
- HTTP method: POST
- test case variants:

/TR03122/TC-AS-FI-ICS2-008/1

Table 2.66 TC-AS-FI-ICS2-008 Test Case Variants*Description*

Step	Description / Expected Result
1	<i>Description:</i> <ul style="list-style-type: none"> • A facial image from the database is sent to the IUT to test the segmentation.

Test Case ID: TC-AS-FI-ICS2-008

Expected Result:

- The IUT delivers a response that is conformant to the schema file trbio5v1.xsd.
- The response contains the correct number of elements based on the XPath expression `./bio:Records/bio:BinaryRecord[@type='jpeg']`. Exactly 2 elements are expected in accordance to the acquisition process.
- The response contains the correct number of elements based on the XPath expression `./bio:Records/bio:BinaryRecord[@type='jpeg' and @externalReference='facialImage']`. Exactly 1 element is expected in accordance to the acquisition process.
- The response contains the correct number of elements based on the XPath expression `./bio:Records/bio:BinaryRecord[@type='jpeg' and @externalReference='segmentationPrediction']`. Exactly 1 element is expected in accordance to the acquisition process.
- The data embedded in the elements `"/bio:Records/bio:BinaryRecord[@type='jpeg']"` of the response XML are JPEG.
- The image containing the facial image with eliminated background has a resolution of exactly 1244 x 1600.
- The image containing the segmentation prediction has a resolution of exactly 1244 x 1600.
- The segmentation of the image is calculated for the set of metrics.
- The pixels of facial image demarked as "non-background" by the segmentation prediction image are identical to the "non-background" pixels of the corresponding request image.
- The pixels of facial image demarked as "background" by the segmentation prediction image are of the same gray color in between #A1A1A1 and #E1E1E1

Table 2.65 Test Case ID: TC-AS-FI-ICS2-008

2.2.6 Test Cases FM AS-FI-ICS3

Test Case ID: TC-AS-FI-ICS3-001

<i>Scope</i>	Examination of correctness of the software module used for integrated camera systems in order to obtain digitised facial images for detection of multiple faces.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The integrated camera system used in the specific application scenario is connected. • The IUT implements an interface for conformance testing where a single image can be captured. • The IUT is able to return the results for every captured image via the test interface. • At least two test subjects are available to test the IUT's behaviour.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-AS-FI-ICS3-001/1/

Table 2.68 TC-AS-FI-ICS3-001 Test Case Variants

<i>Description</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%; text-align: left; padding: 5px;">Step</th> <th style="text-align: left; padding: 5px;">Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="height: 100px;"> </td> <td> </td> </tr> </tbody> </table>	Step	Description / Expected Result		
Step	Description / Expected Result				

Test Case ID: TC-AS-FI-ICS3-001

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's capture area. • The IUT is called via the conformance test interface and a compliant face presentation is performed according to FM AS-FI-ICS3. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A compliant facial image is acquired according to FM AS-FI-ICS3. • The acceptance conditions (i.e. no multiple faces detected) are satisfied and achieved. • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>).
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • More than one biometric subjects are present in the IUT's capture area. • The IUT is called via the conformance test interface and non-compliant face presentation containing multiple faces is performed. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Facial image acquisition by the IUT is omitted. • The acceptance conditions are not met, i.e. the total result of the acquisition is negative.

Table 2.67 Test Case ID: TC-AS-FI-ICS3-001

Test Case ID: TC-AS-FI-ICS3-002

<i>Scope</i>	Examination of correctness of the software module used for integrated camera systems in order to obtain digitised facial images for detecting whether the face of the biometric subject is leaving the capture area.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The integrated camera system used in the specific application scenario is connected. • The IUT implements an interface for conformance testing where a single image can be captured. • The IUT is able to return the results for every captured image via the test interface. • A non-zero timeout is set in the IUT for terminating the process if the face of the biometric subject is leaving the capture area. • One test subject is available to test the IUT's behaviour.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-AS-FI-ICS3-002/1/

Table 2.70 TC-AS-FI-ICS3-002 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>The IUT is called via the conformance test interface and a non-compliant face presentation is performed, i.e. the test subject moves such that the face is not further recognisable, e.g. the test subject moves sideways or rotates sufficiently around the vertical axis, according to FM AS-FI-ICS3.</p>

Test Case ID: TC-AS-FI-ICS3-002

Expected Result:

- Facial image acquisition by the IUT is omitted.
- The process terminates after the timer which starts at the point of leaving the capture area reaches the preset timeout.
- No message containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).

Table 2.69 Test Case ID: TC-AS-FI-ICS3-002

2.2.7 Test Cases FM AS-FP-MF

Test Case ID: TC-AS-FP-MF-001

<i>Scope</i>	Examination of correct functionality of the fingerprint scanners pre-qualification regarding a medium/default setting and test configurability of pre-qualification thresholds, regarding relaxed and strict settings (if supported by the IUT).
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded. • A multi fingerprint scanner is connected. • As necessary test resources: a test person to perform the fingerprint acquisition with. • Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-AS-FP-MF-001/1/

Table 2.72 TC-AS-FP-MF-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Configure a medium pre-qualification threshold (e.g. default value, via software/firmware, consult product documentation). • Initiate test case by calling the IUT via the test interface. • Place fingers on the scanner, at first with slightest pressure. • Successively increase pressure and improve finger position on the scanner, until auto capture is performed. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The automatic activation of the acquisition does not occur immediately. • With improving fingerprint quality over time, the scanner performs the automatic acquisition. • A message is given that the required fingerprints were captured successfully. • As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (<code>bio:FingerAcquisition</code>).
	2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Configure pre-qualification threshold as relaxed as possible. • Initiate test case by calling the IUT via the test interface. • Place fingers on the scanner, at first with slightest pressure. • Successively increase pressure and improve finger position on the scanner.

Test Case ID: TC-AS-FP-MF-001*Expected Result:*

- The automatic activation of the scanner triggers early (in comparison to step 1.).
- A message is given that the required fingerprints were captured successfully.
- As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (`bio:FingerAcquisition`).

3

Description:

- Configure pre-qualification threshold as strict as possible.
- Initiate test case by calling the IUT via the test interface.
- Place fingers on the scanner, at first with slightest pressure.
- Successively increase pressure and improve finger position on the scanner.

Expected Result:

- The automatic activation of the scanner triggers very late (in comparison to step 1.) or not at all.
- A message is given that the required fingerprints were captured successfully respectively no message is given at all.
- As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (`bio:FingerAcquisition` and `bio:Records`).

Table 2.71 Test Case ID: TC-AS-FP-MF-001**Test Case ID: TC-AS-FP-MF-002**

<i>Scope</i>	Examination of the fingerprint scanners resulting image resolution.				
<i>Preconditions</i>	Product documentation of the fingerprint scanner model is at hand (e.g. data sheet, manual, manufacturer declaration).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <i>Description:</i> <ul style="list-style-type: none"> • Verify that the resolution of the fingerprint scanner fulfils the requirements for acquisition setting levels 31 or 41 [ISO_FINGER] • Consult product documentation <i>Expected Result:</i> The documentation attests that the requirements are fulfilled. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<i>Description:</i> <ul style="list-style-type: none"> • Verify that the resolution of the fingerprint scanner fulfils the requirements for acquisition setting levels 31 or 41 [ISO_FINGER] • Consult product documentation <i>Expected Result:</i> The documentation attests that the requirements are fulfilled.
Step	Description / Expected Result				
1	<i>Description:</i> <ul style="list-style-type: none"> • Verify that the resolution of the fingerprint scanner fulfils the requirements for acquisition setting levels 31 or 41 [ISO_FINGER] • Consult product documentation <i>Expected Result:</i> The documentation attests that the requirements are fulfilled.				

Table 2.73 Test Case ID: TC-AS-FP-MF-002**Test Case ID: TC-AS-FP-MF-003**

<i>Scope</i>	Examination of the fingerprint scanners pre-qualification regarding their configuration.				
<i>Preconditions</i>	Product documentation of the fingerprint scanner model is at hand (e.g. data sheet, manual, manufacturer declaration).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <i>Description:</i> <ul style="list-style-type: none"> • Verify that the pre-qualification is configurable by a system administrator • Consult product documentation </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<i>Description:</i> <ul style="list-style-type: none"> • Verify that the pre-qualification is configurable by a system administrator • Consult product documentation
Step	Description / Expected Result				
1	<i>Description:</i> <ul style="list-style-type: none"> • Verify that the pre-qualification is configurable by a system administrator • Consult product documentation 				

Test Case ID: TC-AS-FP-MF-003

Expected Result:

The documentation attests that the requirements are fulfilled.

Table 2.74 Test Case ID: TC-AS-FP-MF-003

2.2.8 Test Cases FM AS-FP-ROLL

Test Case ID: TC-AS-FP-ROLL-001

<i>Scope</i>	Examination of the software module used for rolled fingerprint acquisition
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is running and required modules are loaded • A fingerprint scanner providing rolled fingerprints is connected • Five test persons are available in order to perform fingerprint acquisition • A trained operator conducts the capture process with the test persons
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: GET • test case variants:

/TR03122/TC-AS-FP-ROLL-001/1

Table 2.76 TC-AS-FP-ROLL-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Check the captured rolled fingerprint image</p> <p>For each finger of each test person:</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Start the acquisition • Roll finger uniformly from nail to nail • Examine resulting image from acquisition <p><i>Note:</i></p> <ul style="list-style-type: none"> • It is not required to acquire the fingerprints of all test persons directly in line • It is required to acquire all ten fingerprints of different test persons and not from one test person several times to achieve five capture processes <p>The operator is required to be trained in capturing fingerprints of persons to ensure a realistic finger roll process</p>

Test Case ID: TC-AS-FP-ROLL-001*Expected Result*

As a result per acquisition, a message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (bio:Finger-Acquisition and bio:Records)

For each captured fingerprint image of each test person, the following results are expected:

- The resulting image shows the full width of the rolled fingerprint. Typically the image will roughly be of rectangular shape.
- The captured fingerprint image does not depict visible distortion or interruptions. The captured fingerprint image depicts the fingerprint from nail to nail.
- The captured fingerprint image depicts a faithful reproduction of the fingerprint, especially in the areas where the rolled fingerprint overlaps with the corresponding plain print.
- The captured fingerprint image does not depict visible distortion or interruptions.
- The captured fingerprint image does not depict puzzle effects such that parts of the fingerprint image are displaced from their actual position.
- The captured fingerprint image clearly depicts friction ridges.
- The captured fingerprint image does not depict blurring and smearing.
- The captured fingerprint image clearly depicts ridge patterns.
- If features exist for the given fingerprint:
 - The captured fingerprint image clearly depicts features.
 - If loop features exist for the given fingerprint:
 - The captured fingerprint image clearly depicts loop features (core and delta).
- The captured fingerprint image clearly depicts existing features at the border zone of the image.
- The captured fingerprint image depicts the fingerprint's upper part.
- The captured fingerprint image depicts the fingerprint's core area with ridge lines.
- If delta features exist for the given fingerprint:
 - The captured fingerprint image depicts the fingerprint's delta features.
- The captured fingerprint image depicts the fingerprint's baseline (bottom area).
- The vertical axis of the fingerprint depicted in the captured image is in parallel with the fingerprint image's vertical axis.
- Note: In case of doubt whether one or several of the conditions above hold true for the given fingerprint, a dactyloscopy expert SHALL be consulted for clarification.

Table 2.75 Test Case ID: TC-AS-FP-ROLL-001

Test Case ID: TC-AS-FP-ROLL-002

<i>Scope</i>	Examination of the fingerprint scanners resulting image resolution		
<i>Preconditions</i>	Product documentation of the fingerprint scanner model is at hand (e.g. data sheet, manual, manufacturer declaration)		
<i>CTS Mode</i>	Not supported		
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-AS-FP-ROLL-002

1	<p><i>Description:</i></p> <p>Verify that the resolution of the fingerprint scanner fulfils the requirements for acquisition setting levels 31 or 41 [ISO_FINGER]</p> <p>Consult product documentation</p> <p><i>Expected Result:</i></p> <p>The documentation attests that the requirements are fulfilled</p>
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Table 2.77 Test Case ID: TC-AS-FP-ROLL-002**Test Case ID: TC-AS-FP-ROLL-003**

<i>Scope</i>	Examination of the software module used for rolled fingerprint acquisition	
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is running and required modules are loaded • A fingerprint scanner providing rolled fingerprints is connected • A test person is available in order to perform fingerprint acquisition • A trained operator conducts the capture process with the test person 	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Check the captured rolled fingerprint image</p> <p>For exactly two different fingers of the test person:</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface. • Start the acquisition. • Roll finger from nail to nail, causing blurring and smearing each exactly once. • Examine resulting image from acquisition <p><i>Note:</i></p> <p>The operator is required to be trained in capturing fingerprints of persons to ensure a realistic finger roll process.</p> <p><i>Expected Result:</i></p> <p>For both captured fingerprint images of the test person, the following results are expected:</p> <ul style="list-style-type: none"> • One captured fingerprint image depicts blurring and the other one smearing. • In both cases the acquisition software detects the occurrence of blurring or smearing. • In both cases a warning is shown to the operator. • In both cases the acquisition software does not perform any correction concerning the blurring and smearing.

Table 2.78 Test Case ID: TC-AS-FP-ROLL-003

2.2.9 Test Cases FM AS-FP-SF

Test Case ID: TC-AS-FP-SF-001

<i>Scope</i>	Examination of correct functionality of the fingerprint scanners pre-qualification regarding a medium/default setting and test configurability of pre-qualification thresholds, regarding relaxed and strict settings (if supported by the IUT).
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Test Case ID: TC-AS-FP-SF-001

- Preconditions*
- IUT is running, required modules are loaded.
 - A single fingerprint scanner is connected.
 - As necessary test resources: a test person to perform the fingerprint acquisition with.
 - Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-AS-FP-SF-001/1/

Table 2.80 TC-AS-FP-SF-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Configure a medium pre-qualification threshold (e.g. default value, via software/firmware, consult product documentation). • Initiate test case by calling the IUT via the test interface. • Place single finger on the scanner, at first with slightest pressure. • Successively increase pressure and improve finger position on the scanner, until auto capture is performed. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The automatic activation of the acquisition does not occur immediately. • With improving fingerprint quality over time, the scanner performs the automatic acquisition. • A message is given that the required fingerprint was captured successfully. • As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (<code>bio:FingerAcquisition</code>).
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Configure pre-qualification threshold as relaxed as possible. • Initiate test case by calling the IUT via the test interface. • Place single finger on the scanner, at first with slightest pressure. • Successively increase pressure and improve finger position on the scanner. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The automatic activation of the scanner triggers early (in comparison to step 1.). • A message is given that the required fingerprint was captured successfully. • As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (<code>bio:FingerAcquisition</code>).
3	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Configure pre-qualification threshold as strict as possible. • Initiate test case by calling the IUT via the test interface. • Place single finger on the scanner, at first with slightest pressure. • Successively increase pressure and improve finger position on the scanner.

Test Case ID: TC-AS-FP-SF-001*Expected Result:*

- The automatic activation of the scanner triggers very late (in comparison to step 1.) or not at all.
- A message is given that the required fingerprint was captured successfully respectively no message is given at all.
- As a result, a message conforming to TR-03121 XML containing the encoded fingerprint image in Windows Bitmap Version 3 (BMP) format is returned via the test interface (bio:FingerAcquisition and bio:Records).

Table 2.79 Test Case ID: TC-AS-FP-SF-001**Test Case ID: TC-AS-FP-SF-002**

Scope Examination of the fingerprint scanners pre-qualification regarding their configuration.

Preconditions Product documentation of the fingerprint scanner model is at hand (e.g. data sheet, manual, manufacturer declaration).

CTS Mode Not supported

*Description***Step** **Description / Expected Result**

1

Description:

- Verify that the pre-qualification is configurable by a system administrator
- Consult product documentation

Expected Result:

The documentation attests that the requirements are fulfilled.

Table 2.81 Test Case ID: TC-AS-FP-SF-002

2.2.10 Test Cases FM AS-FP-SLP

Test Case ID: TC-AS-FP-SLP-001

Scope Examination of correctness of automatic classification of left and right hand slap.

Preconditions

- IUT is running, required modules are loaded.
- A four finger slap scanner is connected.
- As necessary test resources: a test person to perform the fingerprint acquisition with.
- Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-AS-FP-SLP-001/1/

Table 2.83 TC-AS-FP-SLP-001 Test Case Variants*Description***Step** **Description / Expected Result**

1

Description:

- Initiate test case by calling the IUT via the test interface.
- Place left hand slap properly on the scanner.
- Perform a capture of the hand slap, e.g. according to PAP Task ACQ-FPS-SV-2: Capture Slap Supervised.

Test Case ID: TC-AS-FP-SLP-001

Expected Result:

- The activation of the acquisition occurs automatically.
- A message is given that the required fingerprints were captured successfully.
- As a result, a message conforming to TR-03121 XML containing the correct slap code is returned via the test interface (`bio:FingerClassifierInformation` within `bio:FingerAcquisition`).

2

Description:

- Initiate test case by calling the IUT via the test interface.
- Place right hand slap properly on the scanner.
- Perform a capturing of the hand slap, e.g. according to PAP Task ACQ-FPS-SV-2: Capture Slap Supervised.

Expected Result:

- The activation of the acquisition occurs automatically.
- A message is given that the required fingerprints were captured successfully.
- As a result, a message conforming to TR-03121 XML containing the correct slap code is returned via the test interface (`bio:FingerClassifierInformation` within `bio:FingerAcquisition`).

Table 2.82 Test Case ID: TC-AS-FP-SLP-001

Test Case ID: TC-AS-FP-SLP-002

<i>Scope</i>	Examination of the performance and configurability of the automated hand slap classification.				
<i>Preconditions</i>	The vendor of the algorithm provides a documentation which gives information about the accuracy of the classification algorithm.				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <i>Description:</i> Examination of the documentation provided by the vendor of the classification algorithm. <i>Expected Result:</i> <ul style="list-style-type: none"> • The documentation gives information of the performance of the algorithm based on a reference database. • The documentation gives evidence that the classification algorithm ensures an accuracy of at least 99%, i.e. 99% of left and right hand slaps are correctly classified. • The documentation gives evidence that the classification algorithm can be calibrated for accuracy levels using configurable thresholds in case the classification algorithm returns more than two possible results, e.g. "left", "right" and "unknown". </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<i>Description:</i> Examination of the documentation provided by the vendor of the classification algorithm. <i>Expected Result:</i> <ul style="list-style-type: none"> • The documentation gives information of the performance of the algorithm based on a reference database. • The documentation gives evidence that the classification algorithm ensures an accuracy of at least 99%, i.e. 99% of left and right hand slaps are correctly classified. • The documentation gives evidence that the classification algorithm can be calibrated for accuracy levels using configurable thresholds in case the classification algorithm returns more than two possible results, e.g. "left", "right" and "unknown".
Step	Description / Expected Result				
1	<i>Description:</i> Examination of the documentation provided by the vendor of the classification algorithm. <i>Expected Result:</i> <ul style="list-style-type: none"> • The documentation gives information of the performance of the algorithm based on a reference database. • The documentation gives evidence that the classification algorithm ensures an accuracy of at least 99%, i.e. 99% of left and right hand slaps are correctly classified. • The documentation gives evidence that the classification algorithm can be calibrated for accuracy levels using configurable thresholds in case the classification algorithm returns more than two possible results, e.g. "left", "right" and "unknown". 				

Table 2.84 Test Case ID: TC-AS-FP-SLP-002

Test Case ID: TC-AS-FP-SLP-003

<i>Scope</i>	Examination of deactivation of automated hand slap classification.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded. • A four finger slap scanner is connected. • As necessary test resources: a test person to perform the fingerprint acquisition with. • Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").

Test Case ID: TC-AS-FP-SLP-003

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-AS-FP-SLP-003/1/

Table 2.86 TC-AS-FP-SLP-003 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Activate automated hand slap classification (e.g. via software/firmware, consult product documentation). • Initiate test case by calling the IUT via the test interface. • Place hand slap properly on the scanner. • Perform a capture of the hand slap, e.g. according to PAP Task ACQ-FPS-SV-2: Capture Slap Supervised. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The activation of the acquisition occurs automatically. • A message is given that the required fingerprints were captured successfully. • As a result, a message conforming to TR-03121 XML containing the correct slap code is returned via the test interface (<code>bio:FingerClassifierInformation</code> within <code>bio:FingerAcquisition</code>).
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Deactivate automated hand slap classification (e.g. via software/firmware, consult product documentation). • Initiate test case by calling the IUT via the test interface. • Place hand slap properly on the scanner. • Perform a capturing of the hand slap, e.g. according to PAP Task ACQ-FPS-SV-2: Capture Slap Supervised. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The activation of the acquisition occurs automatically. • A message is given that the required fingerprints were captured successfully. • As a result, a message conforming to TR-03121 XML containing no slap code is returned via the test interface (<code>bio:FingerClassifierInformation</code> within <code>bio:FingerAcquisition</code>).

Table 2.85 Test Case ID: TC-AS-FP-SLP-003

2.3 Test Cases Biometric Image Processing

2.3.1 Test Cases FM BIP-FI-APP

Test Case ID: TC-BIP-FI-APP-001

- Scope*
- Verify correct facial image processing with respect to the output of integrated camera systems to obtain a facial image. The metrics applied for assessment are based on [ISO_FACE] .

Test Case ID: TC-BIP-FI-APP-001*Preconditions*

- The IUT is in operation, required modules are loaded.
- A database with facial images for conformance test and the CTS are at hand.
- The following definitions according to [ISO_FACE] are relevant for verifying the geometric requirements:
 - The intersection of the vertical line passing through the approximate horizontal midpoints of the mouth and the bridge of the nose, and the horizontal line connecting the centres of the two eyes, is called the centre of the face.
 - The width of the head is defined as the distance between the two imaginary lines parallel to the vertical line mentioned above. Each line is drawn between the upper and lower lobes of each ear and positioned where the external ear connects the head.
 - The length of the head is defined as the distance between the base of the chin and the crown (i.e. the top of the head ignoring any hair) measured on the vertical line mentioned above.

CTS Mode

- interactive
- image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
- HTTP method: POST
- test case variants:

/TR03122/TC-BIP-FI-APP-001/1/

Table 2.88 TC-BIP-FI-APP-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check correct processing of the output of integrated camera systems:</p> <ul style="list-style-type: none"> • Initiate test case by loading the reference facial image using the test interface. • Examine the processed image, i.e.: <ul style="list-style-type: none"> • Determine the width of the image and the head width. • Determine the height of the image and the head length. • Determine the X and Y coordinates of the centre of the face, assuming that the origin of the coordinate system is in the upper left corner of the image.

Test Case ID: TC-BIP-FI-APP-001

Expected Result:

- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).
- The colour depth is 24 bit and the colour space sRGB. Note, for scenarios where only a facial verification is performed a colour depth of 8 bit with grey scale is also possible.
- The face is fully visible in foreground.
- The minimum distance between both eyes is 120 pixels.
- The processed image is cropped and de-rotated.
- The size of the face within the processed image meets the geometric requirements of [ISO_FACE], chapter 8.3, i.e.:
 - The X coordinate of the centre of the face is between 45 % and 55 % of the image width.
 - The Y coordinate of the centre of the face is between 30 % and 50 % (for children under the age of 11 between 30 % and 60 %) of the image height.
 - The head width is between 50 % and 75 % of the image width.
 - The head length is between 60 % and 90 % (for children under the age of 11 between 50 % and 90 %) of the vertical length of the image.

Table 2.87 Test Case ID: TC-BIP-FI-APP-001

2.3.2 Test Cases FM BIP-FI-DC-HQ

Test Case ID: TC-BIP-FI-DC-HQ-001

<i>Scope</i>	Verify correct facial image processing
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • As necessary test resource: <ul style="list-style-type: none"> • A locally available facial image of a test person, with a resolution greater than 1600*1200 pixels (in both height and width) • The IUT SHALL provide an option to select the image output type for the scope of this test case (generic facial image, facial image for German Standard for AFIS Transactions Version 3 (GSAT3) transaction). Alternatively, the IUT can provide both output types in parallel (the output type, which is not needed, can then be discarded/disregarded). • The second test step SHALL only be performed if producing GSAT3 data is in scope of the considered Application Profile. If this is the case, the facial image meeting the specific requirements of the Application Profile must be returned in the defined XML format.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image is provided via XML file using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-BIP-FI-DC-HQ-001/1

Table 2.90 TC-BIP-FI-DC-HQ-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<i>Description:</i> Check correct processing of generic facial images <ul style="list-style-type: none"> • Initiate test case by loading the reference facial image using the test interface • Examine the processed image

Test Case ID: TC-BIP-FI-DC-HQ-001

2	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisitionand bio:Records) • The processed image has dimensions of exactly 1600*1200 pixels (in regard to height and width), if it was larger before. Otherwise the dimensions of the image are unchanged • The height/width ratio of the processed image is 4:3 • The minimum distance between both eyes is at least 120 pixels <p><i>Description:</i></p> <p>Check correct processing of facial images for GSAT3</p> <ul style="list-style-type: none"> • Initiate test case by loading the reference facial image using the test interface • Examine the processed image <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The resulting image data is encoded and returned via the test interface in an appropriate XML format, i.e. as GSAT3 XML embedded within a TR-03121 XML (element bio:XMLRecord[@type="GSAT-xml"]), whereby only the contained facial image data (Element it1:FaceImage) is relevant for this test case • The processed image has dimensions of exactly 800*600 pixels, if it was larger before. Otherwise the dimensions of the image are unchanged (height/width ratio is 4:3) • The minimum distance between both eyes is at least 120 pixels
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Table 2.89 Test Case ID: TC-BIP-FI-DC-HQ-001

2.3.3 Test Cases FM BIP-FI-FBS

Test Case ID: TC-BIP-FI-FBS-001

<i>Scope</i>	Verify correct image processing of application forms and the cropping of the facial image on the application form using a flat bed scanner.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As test resource: an application form with a facial image that fulfills the requirements of "full frontal" specified in [ISO_FACE].
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • Image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-BIP-FI-FBS-001/1

Table 2.92 TC-BIP-FI-FBS-001 Test Case Variants

<i>Description</i>	<table border="0" style="width: 100%;"> <tr> <th style="text-align: left; padding: 5px;">Step</th> <th style="text-align: left; padding: 5px;">Description / Expected Result</th> </tr> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-BIP-FI-FBS-001

1	<p><i>Description:</i></p> <p>Check correct processing of the output of flat bad scanner:</p> <ul style="list-style-type: none"> • Initiate test case by loading the reference application form using the test interface. • Examine the processed image, i.e.: <ul style="list-style-type: none"> • The image crop. • The image width and height. • The colour depth and colour space. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition). • The processed image is cropped. • The face is centered and fully visible in the foreground. • The image dimension is 622 pixels width and 800 pixels height with a tolerance of +/- 10 pixels. • The resulting facial image is a color image (24 bit sRGB) or a grey scale image (8 bit sRGB).
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Table 2.91 Test Case ID: TC-BIP-FI-FBS-001

2.3.4 Test Cases FM BIP-FI-GID

Test Case ID: TC-BIP-FI-GID-001

<i>Scope</i>	Verify correct image processing and the cropping of the facial image using a digital camera.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As test resource: a biometric test subject.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-BIP-FI-GID-001/1

Table 2.94 TC-BIP-FI-GID-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Check correct processing of the output of the digital camera:</p> <ul style="list-style-type: none"> • Position the biometric test subject properly in front of the digital camera. • Initiate test case using the test interface. • Examine the processed image, i.e.: <ul style="list-style-type: none"> • The image crop. • The image width and height. • The colour depth and colour space.

Test Case ID: TC-BIP-FI-GID-001

Expected Result:

- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).
- The processed image is cropped and de-rotated.
- The face is centered and fully visible in the foreground.
- The image size is 1244 x 1600 pixels with an inter eye distance of at least 300 pixels.
- The resulting facial image is a color image (24 bit sRGB).

Table 2.93 Test Case ID: TC-BIP-FI-GID-001

2.3.5 Test Cases FM BIP-FP-APP

The acquisition of fingerprints can be performed with the help of a single fingerprint sensor or a multi fingerprint sensor. In the first case TC-BIP-FP-APP-001 has to be applied, in the second case TC-BIP-FP-APP-002. Furthermore, in the case of four finger sensors TC-BIP-FP-APP-003 has to applied additionally.

Test Case ID: TC-BIP-FP-APP-001

<i>Scope</i>	Examination of segmentation in connection with single finger scanners.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded. • A single fingerprint sensor is connected. • As necessary test resources: a test person to perform the fingerprint acquisition with.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces"). • HTTP method: GET • test case variants:

/TR03122/TC-BIP-FP-APP-001/1/

Table 2.96 TC-BIP-FP-APP-001 Test Case Variants

The test case is repeated 10 times for every test step in order to be able to estimate the quality of the segmentation process. The fingers have to be lifted after every acquisition.

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Start of the acquisition of one fingerprint by correct placement of this finger on the sensor and extraction of the fingerprint image from the resulting data. • Initiate test case by calling the IUT via the test interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing an encoded fingerprint image is returned via the test interface (element bio:FingerAcquisition and bio:Records). • A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated. Note: segmentation for single finger scanners is optional. • No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.

Test Case ID: TC-BIP-FP-APP-001

2

Description:

- Start of the acquisition of one fingerprint by positioning this finger rotated up to 45 degree on the sensor and extraction of the fingerprint image from the resulting data.
- Initiate test case by calling the IUT via the test interface.
- Note: In case the IUT rejects strongly rotated fingerprints such that the capture process does not yield a biometric sample, the capture process can be initiated manually.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing an encoded fingerprint image is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- The fingerprint is corrected to be vertical in the image which is manually verified by the examiner.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated. Note: segmentation for single finger scanners is optional.
- No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.

3

Description:

- Start of the acquisition of one fingerprint by positioning this finger on the sensor such that all phalanges are captured during acquisition and extraction of the fingerprint image from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing an encoded fingerprint image is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- The image contains only the first part of the finger.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated. Note: segmentation for single finger scanners is optional.
- No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.

Table 2.95 Test Case ID: TC-BIP-FP-APP-001

Test Case ID: TC-BIP-FP-APP-002

Scope

Examination of segmentation in connection with multi finger scanners.

Preconditions

- IUT is running, required modules are loaded.
- A multi fingerprint sensor is connected.
- As necessary test resources: a test person to perform the fingerprint acquisition with.

Test Case ID: TC-BIP-FP-APP-002
CTS Mode

- interactive
- no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").
- HTTP method: GET
- test case variants:

/TR03122/TC-BIP-FP-APP-002/1/

Table 2.98 TC-BIP-FP-APP-002 Test Case Variants

The test case is repeated 10 times for every test step in order to be able to evaluate the quality of the segmentation process. The fingers have to be lifted after every acquisition.

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Start of the acquisition of two fingerprints by correct placement of two fingers on the sensor and extraction of the fingerprint images from the resulting data. • Initiate test case by calling the IUT via the test interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing two encoded fingerprint images is returned via the test interface (element <code>bio:FingerAcquisition</code> and <code>bio:Records</code>). • Two independent images are returned within the data. • A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated. • No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Start of the acquisition of one fingerprint by correct placement of one finger on the sensor and extraction of the fingerprint image from the resulting data. • Initiate test case by calling the IUT via the test interface. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing one encoded fingerprint image is returned via the test interface (element <code>bio:FingerAcquisition</code> and <code>bio:Records</code>). • A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated. • No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.
3	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Start of the acquisition of two fingerprints by positioning the fingers rotated up to 45 degrees on the sensor (both fingers in the same direction) and extraction of the fingerprint images from the resulting data. • Initiate test case by calling the IUT via the test interface. • Note: In case the IUT rejects strongly rotated fingerprints such that the capture process does not yield a biometric sample, the capture process can be initiated manually.

Test Case ID: TC-BIP-FP-APP-002

Expected Result:

- As a result, a message conforming to TR-03121 XML containing two encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Two independent images are returned within the data.
- The fingerprints are corrected to be vertical in the image which is manually verified by the examiner.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

4

Description:

- Start of the acquisition of one fingerprint by positioning the finger rotated up to 45 degrees on the sensor and extraction of the fingerprint image from the resulting data.
- Initiate test case by calling the IUT via the test interface.
- Note: In case the IUT rejects strongly rotated fingerprints such that the capture process does not yield a biometric sample, the capture process can be initiated manually.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing an encoded fingerprint image is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- The fingerprint is corrected to be vertical in the image which is manually verified by the examiner.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.

5

Description:

- Start of the acquisition of two fingerprints by positioning two fingers on the sensor such that all phalanges are captured during acquisition and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing two encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Both images contain only the first part of the finger.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

Test Case ID: TC-BIP-FP-APP-002

6

Description:

- Start of the acquisition of one fingerprint by positioning this finger on the sensor such that all phalanges are captured during acquisition and extraction of the fingerprint image from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing one encoded fingerprint image is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Image contains only the first part of the finger.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint image. The fingerprint image may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint image.

Table 2.97 Test Case ID: TC-BIP-FP-APP-002

Test Case ID: TC-BIP-FP-APP-003

Scope

Examination of segmentation in connection with four finger scanners.

Preconditions

- IUT is running, required modules are loaded.
- A multi fingerprint sensor is connected.
- As necessary test resources: a test person to perform the fingerprint acquisition with.

CTS Mode

- interactive
- no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces").
- HTTP method: GET
- test case variants:

/TR03122/TC-BIP-FP-APP-003/1/

Table 2.100 TC-BIP-FP-APP-003 Test Case Variants

The test case is repeated 10 times for every test step in order to be able to evaluate the quality of the segmentation process. The fingers have to be lifted after every acquisition.

Description

Step	Description / Expected Result
------	-------------------------------

1

Description:

- Start of the acquisition of three fingerprints by correct placement of three fingers on the sensor and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Test Case ID: TC-BIP-FP-APP-003

Expected Result:

- As a result, a message conforming to TR-03121 XML containing three encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Three independent images are returned within the data.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

2

Description:

- Start of the acquisition of four fingerprints by correct placement of four fingers on the sensor and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing four encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Four independent images are returned within the data.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

3

Description:

- Start of the acquisition of three fingerprints by positioning the fingers rotated up to 45 degrees on the sensor (all fingers in the same direction) and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.
- Note: In case the IUT rejects strongly rotated fingerprints such that the capture process does not yield a biometric sample, the capture process can be initiated manually.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing three encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Three independent images are returned within the data.
- The fingerprints are corrected to be vertical in the image which is manually verified by the examiner.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

Test Case ID: TC-BIP-FP-APP-003

4

Description:

- Start of the acquisition of four fingerprints by positioning the fingers rotated up to 45 degrees on the sensor (all fingers in the same direction) and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.
- Note: In case the IUT rejects strongly rotated fingerprints such that the capture process does not yield a biometric sample, the capture process can be initiated manually.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing four encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Four independent images are returned within the data.
- The fingerprints are corrected to be vertical in the image which is manually verified by the examiner.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

5

Description:

- Start of the acquisition of three fingerprints by positioning three fingers on the sensor such that all phalanges are captured during acquisition and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Expected Result:

- As a result, a message conforming to TR-03121 XML containing three encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Three independent images are returned within the data.
- All images contain only the first part of the finger.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

6

Description:

- Start of the acquisition of four fingerprints by positioning four fingers on the sensor such that all phalanges are captured during acquisition and extraction of the fingerprint images from the resulting data.
- Initiate test case by calling the IUT via the test interface.

Test Case ID: TC-BIP-FP-APP-003

Expected Result:

- As a result, a message conforming to TR-03121 XML containing four encoded fingerprint images is returned via the test interface (element `bio:FingerAcquisition` and `bio:Records`).
- Four independent images are returned within the data.
- Each image contains only the first part of the finger.
- A correct segmentation has been performed. In case of uncertainty, the test SHALL be repeated.
- No upscaling has been applied to the fingerprint images. The fingerprint images may have been evenly surrounded with white pixels to reach the desired size if the targeted system or database requires fingerprint images of higher size than captured the fingerprint images.

Table 2.99 Test Case ID: TC-BIP-FP-APP-003

2.4 Test Cases Quality Assessment

2.4.1 Test Cases FM QA-FI-ARE

Test Case ID: TC-QA-FI-ARE-001

<i>Scope</i>	Examination of the software-based quality assessment for facial images within the context of alien register enrolment. The test object consists of the quality assessment software and a fixed parameter set describing the application profile specific tolerances threshold regarding several assessment criteria.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand. • The database contains: <ul style="list-style-type: none"> • Compliant images and non-compliant images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion. • Acceptance conditions (error rates) for each criterion, based on the statistical significance of data in the database for the corresponding criterion. • The IUT implements an interface for conformance testing where a single image can be provided and the computed quality values and configuration data are returned. • The IUT is able to return the results from the quality assessment for every provided image via the test interface.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-QA-FI-ARE-001/1

Table 2.102 TC-QA-FI-ARE-001 Test Case Variants

Description

Step	Description / Expected Result
------	-------------------------------

Test Case ID: TC-QA-FI-ARE-001

1

Description:

- The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

2

Description:

- The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Test Case ID: TC-QA-FI-ARE-001

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

3

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-ARE. This has to be done for all criteria that have been identified as mandatory.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result
- The acceptance conditions are not met, i.e. the total result of the quality evaluation is negative.

Test Case ID: TC-QA-FI-ARE-001

4

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-ARE. This has to be done for all criteria that have been identified as optional.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-ARE.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result

Table 2.101 Test Case ID: TC-QA-FI-ARE-001

2.4.2 Test Cases FM QA-FI-BCL

Test Case ID: TC-QA-FI-BCL-001

<i>Scope</i>	Examination of the software-based quality assessment for facial images within the context of border control. The test object consists of the quality assessment software and a fixed parameter set describing the application profile specific tolerances threshold regarding several assessment criteria.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand. • The database contains: <ul style="list-style-type: none"> • Compliant images and non-compliant images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion. • Acceptance conditions (error rates) for each criterion, based on the statistical significance of data in the database for the corresponding criterion. • The IUT implements an interface for conformance testing where a single image can be provided and the computed quality values and configuration data are returned. • The IUT is able to return the results from the quality assessment for every provided image via the test interface.

Test Case ID: TC-QA-FI-BCL-001

CTS Mode

- automatic
- Image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
- HTTP method: POST
- test case variants:

/TR03122/TC-QA-FI-BCL-001/1

Table 2.104 TC-QA-FI-BCL-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-BCL. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • For every facial image a "bio:FaceQuality" element is returned by the IUT via the test interface. • The IUT provides the quality values for all criteria marked with "M" in the respective table for quality threshold requirements of Function Module QA-FI-BCL. • If applicable, the quality values are correctly set: <ul style="list-style-type: none"> • "id" (type string) – identifier for the criteria • "min" (type double) – minimum value from the range of this criteria • "max" (type double) – maximum value from the range of this criteria • "tmin" (type double) – minimum value of the allowed tolerance range of this criteria • "tmax" (type double) – maximum value of the allowed tolerance range of this criteria • "result" (type double) value of the quality evaluation result. • The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied: <ul style="list-style-type: none"> • $tmin \geq min, tmax \leq max$ • $min \leq result \leq max$
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-BCL. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Test Case ID: TC-QA-FI-BCL-001

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-BCL.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

3

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-BCL. This has to be done for all criteria that have been identified as mandatory.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-BCL.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result
- The acceptance conditions are not met, i.e. the total result of the quality evaluation is negative.

Test Case ID: TC-QA-FI-BCL-001

4

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-BCL. This has to be done for all criteria that have been identified as optional.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-BCL.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result

Table 2.103 Test Case ID: TC-QA-FI-BCL-001

2.4.3 Test Cases FM QA-FI-GENERIC

Test Case ID: TC-QA-FI-GENERIC-001

<i>Scope</i>	Examination of the software-based quality assessment for facial images regarding the generic quality evaluation criteria. Note that the examination for fixed parameters and thresholds are not part of this test case, as they are specified by the volume specific Function Module.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand. • The database contains: <ul style="list-style-type: none"> • Compliant images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion. • Acceptance conditions (error rates) for each criterion, based on the statistical significance of data in the database for the corresponding criterion. • The IUT implements an interface for conformance testing where a single image can be provided and the computed quality values and configuration data are returned. • The IUT is able to return the results from the quality assessment for every provided image via the test interface.

Test Case ID: TC-QA-FI-GENERIC-001

CTS Mode

- automatic
- Image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
- HTTP method: POST
- test case variants:

/TR03122/TC-QA-FI-GENERIC-001/1

Table 2.106 TC-QA-FI-GENERIC-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to QA-FI-GENERIC criteria. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • For every facial image a "bio:FaceQuality" element is returned by the IUT via the test interface. • The IUT provides the quality values for all criteria marked with "M" in the respective Function Module. • If applicable, the quality values are correctly set: <ul style="list-style-type: none"> • "id" (type string) – identifier for the criteria • "min" (type double) – minimum value from the range of this criteria • "max" (type double) – maximum value from the range of this criteria • "tmin" (type double) – minimum value of the allowed tolerance range of this criteria • "tmax" (type double) – maximum value of the allowed tolerance range of this criteria • "result" (type double) value of the quality evaluation result. • The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied: <ul style="list-style-type: none"> • $tmin \geq min, tmax \leq max$ • $min \leq result \leq max$
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to QA-FI-GENERIC criteria. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Test Case ID: TC-QA-FI-GENERIC-001

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective Function Module.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

Table 2.105 Test Case ID: TC-QA-FI-GENERIC-001

Test Case ID: TC-QA-FI-GENERIC-002

<i>Scope</i>	Examination of correctness of the Quality Assessment module for identification of the best capture. The test object consists of the quality assessment software and a fixed parameter set describing the application profile specific tolerances threshold regarding several assessment criteria. Note that there exist different variants of this testcase.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is in operation, required modules are loaded • As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand. • The database contains: <ul style="list-style-type: none"> • Sequences of images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion. • Ground Truth for best capture of each image sequence according to the best capture identification process defined in the respective Function Module. • The IUT implements an interface for conformance testing where a sequence of images can be provided and the computed quality values and configuration data are returned. • The IUT is able to return the results from the quality assessment for every provided sequence of images via the test interface.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-QA-FI-GENERIC-002/1

Table 2.108 TC-QA-FI-GENERIC-002 Test Case Variants

Description

Step Description / Expected Result

Test Case ID: TC-QA-FI-GENERIC-002

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • All face image sequences from the conformance test database for this test case are committing consecutively. • The test case is initiated by calling the IUT via the test interface. <p><i>Expected Result:</i></p> <p>For every input sequence the final selected face image capture and quality information (bio:FaceAcquisition) is returned by the IUT via the test interface.</p>
2	<p><i>Description:</i></p> <p>Examination of correct identification and comparison of the IUT's selection of the best capture out of multiple captures with the Ground Truth database.</p> <p><i>Expected Result:</i></p> <p>All best captures (as specified in the Ground Truth database) are identical with the actual received results of face images and corresponding quality information.</p>

Table 2.107 Test Case ID: TC-QA-FI-GENERIC-002

2.4.4 Test Cases FM QA-FI-GID

Test Case ID: TC-QA-FI-GID-001

<i>Scope</i>	<p>Examination of the software-based quality assessment for facial images within the context of german identity documents.</p> <p>The test object consists of the quality assessment software and a fixed parameter set describing the application profile specific tolerances threshold regarding several assessment criteria.</p>
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand. • The database contains: <ul style="list-style-type: none"> • Compliant images and non-compliant images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion. • Acceptance conditions (error rates) for each criterion, based on the statistical significance of data in the database for the corresponding criterion. • The IUT implements an interface for conformance testing where a single image can be provided and the computed quality values and configuration data are returned. • The IUT is able to return the results from the quality assessment for every provided image via the test interface.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-QA-FI-GID-001/1

Table 2.110 TC-QA-FI-GID-001 Test Case Variants*Description*

Step	Description / Expected Result
------	-------------------------------

Test Case ID: TC-QA-FI-GID-001

1

Description:

- The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-GID.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-GID.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

2

Description:

- The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-GID.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Test Case ID: TC-QA-FI-GID-001

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-GID.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

3

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-GID. This has to be done for all criteria that have been identified as mandatory.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-GID.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result
- The acceptance conditions are not met, i.e. the total result of the quality evaluation is negative.

Test Case ID: TC-QA-FI-GID-001

4

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-GID. This has to be done for all criteria that have been identified as optional.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-GID.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result

Table 2.109 Test Case ID: TC-QA-FI-GID-001

2.4.5 Test Cases FM QA-FI-IMA

Test Case ID: TC-QA-FI-IMA-001

Scope

Examination of the software-based quality assessment for facial images within the context of immigration authorities.

The test object consists of the quality assessment software and a fixed parameter set describing the application profile specific tolerances threshold regarding several assessment criteria.

Preconditions

- The IUT is in operation, required modules are loaded.
- As necessary test resources, a Ground Truth database for conformance test and the CTS are at hand.
- The database contains:
 - Compliant images and non-compliant images for all criteria to be tested. The size of an image can be up to 2.1MB. The total number of images can be up to 200 images per criterion.
 - acceptance conditions (error rates) for each criterion, based on the statistical significance of data in the database for the corresponding criterion.
- The IUT implements an interface for conformance testing where a single image can be provided and the computed quality values and configuration data are returned.
- The IUT is able to return the results from the quality assessment for every provided image via the test interface.

Test Case ID: TC-QA-FI-IMA-001*CTS Mode*

- automatic
- image provision as JPEG or JPEG 2000 using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
- HTTP method: POST
- test case variants:

/TR03122/TC-QA-FI-IMA-001/1

Table 2.112 TC-QA-FI-IMA-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-IMA. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • For every facial image a "bio:FaceQuality" element is returned by the IUT via the test interface. • The IUT provides the quality values for all criteria marked with "M" in the respective table for quality threshold requirements of Function Module QA-FI-IMA. • If applicable, the quality values are correctly set: <ul style="list-style-type: none"> • "id" (type string) – identifier for the criteria • "min" (type double) – minimum value from the range of this criteria • "max" (type double) – maximum value from the range of this criteria • "tmin" (type double) – minimum value of the allowed tolerance range of this criteria • "tmax" (type double) – maximum value of the allowed tolerance range of this criteria • "result" (type double) value of the quality evaluation result. • The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied: <ul style="list-style-type: none"> • $tmin \geq min, tmax \leq max$ • $min \leq result \leq max$
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-IMA. • The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Test Case ID: TC-QA-FI-IMA-001

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-IMA.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result.
- The acceptance conditions (i.e. defined tolerances, depending on the specific application at hand) are satisfied:
 - $tmin \geq min, tmax \leq max$
 - $min \leq result \leq max$

3

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-IMA. This has to be done for all criteria that have been identified as mandatory.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT provides the quality values for all criteria marked with “M” in the respective table for quality threshold requirements of Function Module QA-FI-IMA.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result
- The acceptance conditions are not met, i.e. the total result of the quality evaluation is negative.

Test Case ID: TC-QA-FI-IMA-001

4

Description:

- The IUT is called via the conformance test interface and non-compliant facial images from the conformance test database are committed consecutively according to the respective table for quality threshold requirements of Function Module QA-FI-IMA. This has to be done for all criteria that have been identified as optional.
- The results returned by the IUT are checked (depending on the specific application profile at hand) if the expected quality values are available.

Expected Result:

- For every facial image a “bio:FaceQuality” element is returned by the IUT via the test interface.
- The IUT may provide quality values for criteria marked with “O” in the respective table for quality threshold requirements of Function Module QA-FI-IMA.
- If applicable, the quality values are correctly set:
 - “id” (type string) – identifier for the criteria
 - “min” (type double) – minimum value from the range of this criteria
 - “max” (type double) – maximum value from the range of this criteria
 - “tmin” (type double) – minimum value of the allowed tolerance range of this criteria
 - “tmax” (type double) – maximum value of the allowed tolerance range of this criteria
 - “result” (type double) value of the quality evaluation result

Table 2.111 Test Case ID: TC-QA-FI-IMA-001

2.4.6 Test Cases FM QA-FP-APP

Test Case ID: TC-QA-FP-APP-001

Scope Examination of correctness of the Quality Assessment module for fingerprint acquisition sequence 4-4-2.

Preconditions

- IUT is running, a Ground Truth database for conformance test and the CTS are at hand.
- The test database contains:
 - Sequences of fingerprint images including corresponding finger codes.
 - Corresponding Ground Truth values.

CTS Mode

- automatic
- Image provision as Windows Bitmap Version 3 (BMP) using the test interface (BSI TR-03122-1, Chapter 4, “Conformance Test Interfaces”), whereby multiple segmented single fingerprint images are provided (encoded in biocts-testsetup XML).
- HTTP method: POST
- test case variants:

/TR03122/TC-QA-FP-APP-001/1

Table 2.114 TC-QA-FP-APP-001 Test Case Variants*Description***Step****Description / Expected Result**

1

Description:

Start of the module by committing consecutively all fingerprints sequences for this test case from the conformance test database.

Initiate test case by calling the IUT via the test interface.

Test Case ID: TC-QA-FP-APP-001*Expected Result:*

For every input sequence an XML element is returned, containing the final selected sets of fingerprints (bio:Records) and the corresponding capture and quality information (bio:FingerAcquisition).

2

Description:

Examination of correct identification and comparison of the IUTs selection of the best capture out of multiple captures with the Ground Truth database.

Expected Result:

All expected finger codes and best sets of captures (as specified in the Ground Truth database) are identical with the actual received results of finger codes and returned fingerprint sequences and corresponding quality information.

Table 2.113 Test Case ID: TC-QA-FP-APP-001**Test Case ID: TC-QA-FP-APP-002**

Scope Examination of correctness of the Quality Assessment module for fingerprint acquisition sequence 4-1-4-1.

Preconditions

- IUT is running, a Ground Truth database for conformance test and the CTS are at hand.
- The test database contains:
 - Sequences of fingerprint images including corresponding finger codes.
 - Corresponding Ground Truth values.

CTS Mode

- automatic
- Image provision as Windows Bitmap Version 3 (BMP) using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces"), whereby multiple segmented single fingerprint images are provided (encoded in biocts-testsetup XML).
- HTTP method: POST
- test case variants:

/TR03122/TC-QA-FP-APP-002/1

Table 2.116 TC-QA-FP-APP-002 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Start of the module by committing consecutively all fingerprints sequences for this test case from the conformance test database.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <p>For every input sequence an XML element is returned, containing the final selected sets of fingerprints (bio:Records) and the corresponding capture and quality information (bio:FingerAcquisition).</p>
2	<p><i>Description:</i></p> <p>Examination of correct identification and comparison of the IUTs selection of the best capture out of multiple captures with the Ground Truth database.</p> <p><i>Expected Result:</i></p> <p>All expected finger codes and best sets of captures (as specified in the Ground Truth database) are identical with the actual received results of finger codes and returned fingerprint sequences and corresponding quality information.</p>

Table 2.115 Test Case ID: TC-QA-FP-APP-002

Test Case ID: TC-QA-FP-APP-003

<i>Scope</i>	Examination of correctness of NFIQ2 algorithm implementation.
<i>Preconditions</i>	<ul style="list-style-type: none"> IUT is running, a Ground Truth database for conformance test and the CTS are at hand The test database contains: <ul style="list-style-type: none"> Fingerprint images including corresponding finger codes. Fingerprint images with 500 ppi and 1000 ppi (only if IUT captures fingerprints in 1000 ppi). Corresponding NFIQ2 [NFIQ2] quality values as Ground Truth. For every provided image, the results from the quality assessment are returned by the IUT.
<i>CTS Mode</i>	<ul style="list-style-type: none"> automatic Image provision as Windows Bitmap Version 3 (BMP) using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces"). HTTP method: POST test case variants:

/TR03122/TC-QA-FP-APP-003/1

Table 2.118 TC-QA-FP-APP-003 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>The fingerprint images are consecutively passed to the IUT. If necessary, they are resampled for quality evaluation.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> In case the fingerprint image has a resolution of 500 ppi, no resampling is performed. In case the fingerprint image has a resolution of 1000 ppi, the image is resampled to 500 ppi.
2	<p><i>Description:</i></p> <p>The quality evaluation is consecutively performed for each fingerprint image and compared to the Ground Truth values.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> For each passed fingerprint image a result containing a "bio:FingerQuality" element is returned by the IUT via the test interface. The quality value returned by the IUT for the current fingerprint image equals the corresponding Ground Truth value. <p>Note: Minor deviations of the quality value from the Ground Truth may only be acceptable after a case specific analyse of the reasoning.</p>
3	<p><i>Description:</i></p> <p>Data expected to yield an error code (in BMP format) during quality assessment is used as input for the IUT.</p> <p>Initiate test case by calling the IUT via the test interface</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> For such a passed data a result containing a "bio:FingerQuality" element is returned by the IUT via the test interface. The decimal error code 255 is returned therein, indicating an error during quality computation.

Table 2.117 Test Case ID: TC-QA-FP-APP-003

Test Case ID: TC-QA-FP-APP-004

<i>Scope</i>	Examination of correctness of the Quality Assessment module for fingerprint acquisition of a 4-finger slap.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, a Ground Truth database for conformance test and the CTS are at hand. • The test database contains: <ul style="list-style-type: none"> • Sequences of fingerprint images including corresponding finger codes. • Corresponding Ground Truth values.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision as Windows Bitmap Version 3 (BMP) using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces"), whereby multiple segmented single fingerprint images are provided (encoded in biocts-testsetup XML). • HTTP method: POST • test case variants:

/TR03122/TC-QA-FP-APP-004/1

Table 2.120 TC-QA-FP-APP-004 Test Case Variants

<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Start of the module by committing consecutively all fingerprints for this test case from the conformance test database.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <p>For every input sequence an XML element is returned, containing the final selected sets of fingerprints (<code>bio:Records</code>) and the corresponding capture and quality information (<code>bio:FingerAcquisition</code>).</p> </td> </tr> <tr> <td>2</td> <td> <p><i>Description:</i></p> <p>Examination of correct identification and comparison of the IUTs selection of the best capture out of multiple captures with the Ground Truth database.</p> <p><i>Expected Result:</i></p> <p>All expected finger codes and best sets of captures (as specified in the Ground Truth database) are identical with the actual received results of finger codes and returned fingerprint sequences and corresponding quality information.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Start of the module by committing consecutively all fingerprints for this test case from the conformance test database.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <p>For every input sequence an XML element is returned, containing the final selected sets of fingerprints (<code>bio:Records</code>) and the corresponding capture and quality information (<code>bio:FingerAcquisition</code>).</p>	2	<p><i>Description:</i></p> <p>Examination of correct identification and comparison of the IUTs selection of the best capture out of multiple captures with the Ground Truth database.</p> <p><i>Expected Result:</i></p> <p>All expected finger codes and best sets of captures (as specified in the Ground Truth database) are identical with the actual received results of finger codes and returned fingerprint sequences and corresponding quality information.</p>
Step	Description / Expected Result						
1	<p><i>Description:</i></p> <p>Start of the module by committing consecutively all fingerprints for this test case from the conformance test database.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <p>For every input sequence an XML element is returned, containing the final selected sets of fingerprints (<code>bio:Records</code>) and the corresponding capture and quality information (<code>bio:FingerAcquisition</code>).</p>						
2	<p><i>Description:</i></p> <p>Examination of correct identification and comparison of the IUTs selection of the best capture out of multiple captures with the Ground Truth database.</p> <p><i>Expected Result:</i></p> <p>All expected finger codes and best sets of captures (as specified in the Ground Truth database) are identical with the actual received results of finger codes and returned fingerprint sequences and corresponding quality information.</p>						

Table 2.119 Test Case ID: TC-QA-FP-APP-004

2.5 Test Cases Presentation Attack Detection

2.5.1 Test Cases FM PAD-FI-APP and APP1

Note, test cases 001 and 002 are interchangeable alternatives to each other.

Test Case ID: TC-PAD-FI-APP-001

<i>Scope</i>	Examination of the Common Criteria certification of the Presentation Attack Detection (PAD) sub-system.				
<i>Preconditions</i>	Product documentation and Common Criteria Agreement certificate of the facial image camera system is at hand (e.g. data sheet, manual, manufacturer declaration).				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Consult product documentation and verify that the subsystem certification meets the requirements.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Consult product documentation and verify that the subsystem certification meets the requirements.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Consult product documentation and verify that the subsystem certification meets the requirements.</p>				

Test Case ID: TC-PAD-FI-APP-001

Expected Result:

The documentation attest that the system is certified under the Common Criteria Agreement according the following Protection Profile: BSI-CC-PP-0118-2022: Common Criteria Protection Profile - Biometric Mechanisms Protection Profile (BMPP, Version 2.0, base PP and at least the functional package PAD)

Table 2.121 Test Case ID: TC-PAD-FI-APP-001

Test Case ID: TC-PAD-FI-APP-002

<i>Scope</i>	Examination of availability and correctness of PAD functionality in the context of the acquisition of facial images with and without Presentation Attack Instrument (PAI) in use.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The camera system used in the specific application scenario is connected. • The IUT implements an interface for conformance testing where a single image can be captured. • The PAD functionality of the IUT is activated for performing the test case. • The IUT is able to return the results for every captured image via the test interface. • The IUT is able to return the results for the conducted PAD. • Four different artefacts of each of the eight artefact classes SHALL be created, so that a total of 32 artefacts are obtained. These artefacts SHOULD be usually constructed before testing begins. For every testrun new artefacts SHOULD be constructed. The following artefacts (partial and full) can be used during test cases: <ol style="list-style-type: none"> 1. Masks created from casted silicon, big (size of a face) and small (smaller than a normal face), in different thicknesses: 3-D presentation 2. Masks created from latex in different thicknesses and styles: 3-D presentation 3. Masks printed on paper in different thicknesses and styles: 3-D presentation, the photograph of the biometric subject is printed on paper but presented in a 3-D manner (used as a mask) 4. Masks printed with 3D-printer in different thicknesses and styles: 3-D presentation 5. Photographs displayed on electronic devices, e.g. phones, tablets, etc.: 2-D presentation 6. Videos displayed on electronic devices, e.g. phones, tablets, etc.: 2-D presentation 7. Faces printed on paper with different thicknesses and structures of paper and different structures of printing (colouring, etc.): 2-D presentation, a photograph of the biometric subject is presented to the system as a flat paper copy. 8. Faces printed on fabrics with different thicknesses and structures of the fabrics and different methods of printing (flock print, silk screening, etc.): 2-D or 3-D presentation, a photograph of the biometric subject is presented to the system on fabrics (e.g. on a t-shirt). A 3-D presentation can materialise if pieces of clothing are used by the biometric subject. • In each step slight alterations in the presentation are allowed (e.g. covering of integrated lights, wearing additional accessories like glasses.) • For the selection of electronic devices for the artefact classes 5 and 6, the following requirements shall apply: <ul style="list-style-type: none"> • At least three different devices from three different manufacturers are used. • No device is older than five years (calculated from the date of release in Germany). • At least one smartphone and one tablet is used. • At least three different biometric subjects SHALL present bona fide faces during the test case. • In teststeps 2-6, if the IUT (repeatable) does not accept a presentation and delivers the result "no face found" (or alike), the presentation is counted as "detected".

Test Case ID: TC-PAD-FI-APP-002

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAD-FI-APP-002/1/

Table 2.123 TC-PAD-FI-APP-002 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and a compliant face presentation is performed. • At least three biometric subjects perform a compliant face presentation (bona fide) in the IUT's capture area. The bona fide face of each biometric subject SHALL be tested 20 times (meaning 60 compliant bona fide presentations overall). <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A compliant facial image is acquired. • All acceptance conditions for the facial image acquisition are satisfied and achieved. • No PAD alarm is shown to the operator. • The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. • The PAD score returned by the IUT indicates a bona fide face presentation. • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).
2	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and a face presentation is performed. • At least two biometric subjects present each mask made from different materials including paper, silicon, printed 3D and latex, either by wearing the mask or by using a special construction in the IUT's capture area. Each artefact SHALL be tested ten times. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A facial image is acquired. • A PAD alarm is shown to the operator. • The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. • The PAD score returned by the IUT indicates a presentation attack. • A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).

Test Case ID: TC-PAD-FI-APP-002

3

Description:

- The IUT is called via the conformance test interface and a face presentation is performed.
- At least two biometric subjects present photographs displayed on electronic devices (e.g. phones etc.) where different methods of displaying might be used, either by holding the display into the camera or by using a special construction in the IUT's capture area. Each artefact SHALL be tested ten times.

Expected Result:

- A facial image is acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application.
- The PAD score returned by the IUT indicates a presentation attack.
- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).

4

Description:

- The IUT is called via the conformance test interface and a face presentation is performed.
- At least two biometric subjects present videos displayed on electronic devices, especially showing motion of a biometric subject, either by holding the display into the camera or by using a special construction in the IUT's capture area. Each artefact SHALL be tested ten times.

Expected Result:

- A facial image is acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application.
- The PAD score returned by the IUT indicates a presentation attack.
- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).

5

Description:

- The IUT is called via the conformance test interface and a face presentation is performed.
- At least two biometric subjects present photographs printed on paper (parts of the face or complete face with holes in the paper) with different thicknesses, either by holding the picture into the camera, by wrapping it around the face or by using a special construction in the IUT's capture area. Each artefact SHALL be tested ten times.

Expected Result:

- A facial image is acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application.
- The PAD score returned by the IUT indicates a presentation attack.
- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).

Test Case ID: TC-PAD-FI-APP-002

6

Description:

- The IUT is called via the conformance test interface and a face presentation is performed.
- At least two biometric subjects present photographs printed on fabrics, e.g. t-shirt, with different thicknesses and structures of the fabrics, either by holding the picture into the camera or by using a special construction in the IUT's capture area. Each artefact SHALL be tested ten times.

Expected Result:

- A facial image is acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application.
- The PAD score returned by the IUT indicates a presentation attack.
- A message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).

Evaluation

- An artefact is considered as detected, if the device shows a PAD alarm in six out of ten attempts.
- A device failed the total test, if a single artefact class never triggered a PAD alarm.
- A device failed the total test, if nine or more artefacts in total were not detected as stated above.
- A device failed the total test, if more than three of the bona fide facial images are not recognized as bona fide. Failures of detection from the other test steps do not count for this requirement. Note that during certification a more relaxed false-alarm-rate is tested than specified within the respective Function Module. The requirement of the rate specified in the respective Function Module is tested on operational collected data only.

Table 2.122 Test Case ID: TC-PAD-FI-APP-002

2.5.2 Test Cases FM PAD-FP-APP and APP1

Note, test cases 001 and 002 are interchangeable alternatives to each other.

Test Case ID: TC-PAD-FP-APP-001

<i>Scope</i>	Examination of the Common Criteria certification of the PAD subsystem.
<i>Preconditions</i>	Product documentation and Common Criteria Agreement certificate of the fingerprint scanner model is at hand (e.g. data sheet, manual, manufacturer declaration).
<i>CTS Mode</i>	Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Consult product documentation and verify that the subsystem certification meets the requirements.</p> <p><i>Expected Result:</i></p> <p>The documentation attest that the system is certified under the Common Criteria Agreement according to one of the following Protection Profiles:</p> <ul style="list-style-type: none"> • BSI-CC-PP-0063-2010: Fingerprint Spoof Detection Protection Profile (FSD-PP). • BSI-CC-PP-0062-2010: Fingerprint Spoof Detection Protection Profile based on Organisational Security Policies (FSDPP_OSP). • BSI-CC-PP-0118-2022: Common Criteria Protection Profile - Biometric Mechanisms Protection Profile (BMPP, Version 2.0, base PP and at least the functional package PAD)

Table 2.124 Test Case ID: TC-PAD-FP-APP-001

Note, if test case 002 is performed during stand alone testing of PAD functionality of finger print scanners, the usage of the CTS is OPTIONAL. When not using the CTS the results (PAD score, binary PAD result, configured thresholds and NIFQ2 score for each acquired finger) are allowed to be provided in other ways than the defined `bio:FingerAcquisition XML`.

Test Case ID: TC-PAD-FP-APP-002

Scope Examination of availability and correctness of PAD functionality and finger codes in the context of the acquisition of fingerprint images with and without PAI in use.

Preconditions

- The IUT is in operation, required modules are loaded.
- The scanner used in the specific application scenario is connected.
- The IUT implements an interface for conformance testing where fingerprints can be captured.
- The PAD functionality of the IUT is activated for performing the test case.
- The IUT is able to return the results for every captured finger via the test interface.
- The IUT is able to return the results for the conducted PAD.
- Three different artefacts of each of the seven artefact classes SHALL be created, so that a total of 21 artefacts are obtained. The following artefacts classes (fingertips in different thicknesses and/or massive fingers) SHALL be used during test cases:
 1. Artefacts created from different kinds of silicon, in different colouring
 2. Artefacts created from different kinds of latex, in different colouring
 3. Artefacts created from different kinds of gelatine, in different colouring
 4. Artefacts created from different kinds of wood glue, in different colouring
 5. Artefacts created from different kinds of window painting, in different colouring
 6. Artefacts created from different kinds of paper, in different colouring
 7. Artefacts created from different kinds of latex with window painting (using the following ratios: 2:1, 1:1, 1:2), in different colouring
- The materials of the different artefact classes SHALL NOT be mixed. Different kinds of each artefact class MAY be created adding glycerol (0.5 ml per gramm of artefact class material maximum) and/or graphite (5 knife-point per gramm of artefact class material maximum). For each testrun, new artefacts MAY be created.
- Artefacts SHALL provide a NFIQ-2.2-score of at least 30 (or an equivalent score with other NFIQ versions).
- At least three different biometric subjects (with generally good fingerprints) SHALL present bona fide fingerprints during the test case.

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-PAD-FP-APP-002/1/

Table 2.126 TC-PAD-FP-APP-002 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • The IUT is called via the conformance test interface and a compliant fingerprint presentation is performed. • At least three biometric subjects perform a compliant fingerprint presentation (bona fide). The bona fide fingerprint of each biometric subject SHALL be tested 20 times (meaning 60 compliant bona fide presentations overall).

Test Case ID: TC-PAD-FP-APP-002

Expected Result:

- A compliant fingerprint image is acquired.
- All acceptance conditions for the fingerprint image acquisition are satisfied and achieved.
- No PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a bona fide fingerprint presentation.
- The overall PAD score returned by the IUT indicates no PAD alarms.
- A message conforming to TR-03121 XML containing the encoded fingerprint image is returned via the test interface (`bio:FingerAcquisition`).

2

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from silicon. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

Test Case ID: TC-PAD-FP-APP-002

3

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from latex. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

4

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from gelatine. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Test Case ID: TC-PAD-FP-APP-002

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

5

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from wood glue. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

Test Case ID: TC-PAD-FP-APP-002

6

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from window painting. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

7

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from paper. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Test Case ID: TC-PAD-FP-APP-002

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

8

Description:

- The IUT is called via the conformance test interface and a fingerprint presentation attack is performed, using the artefacts created from latex with window painting. Each artefact SHALL be tested ten times.
- To test whether the fingers for which there is a positive PAD result are also assigned to the correct finger codes, proceed as follows:
 - The artefact SHOULD be present for at least three different fingers of at least one hand.
 - Exactly one finger of exactly one hand SHOULD be equipped with the artefact per fingerprint acquisition.
 - In order to ensure that not always the same finger is equipped with an artefact for each fingerprint acquisition, a rotation principle should be in place that specifies that the equipment of a finger with an artefact changes or rolls in each pass.

Expected Result:

- Fingerprint images are acquired.
- A PAD alarm is shown to the operator.
- The IUT's PAD returns its detection results in the form of a normalized PAD score in the range [0,1] where 0 indicates bona fide and 1 presentation attack to the calling application. Also, an overall PAD score (boolean) is returned.
- The individual PAD scores returned by the IUT indicate a presentation attack for fingers with artefacts and bona fide for fingers without artefacts.
- The overall PAD score returned by the IUT indicates a PAD alarm.
- Every finger originating from an artefact is correctly assigned to its corresponding finger code. (Abstract example: If there is a hand with four bona fide fingers and one finger originating from an artefact, then the PAD score stating it is a presentation attack is assigned to the corresponding finger. Concrete example: If there is a hand with only the index finger coming from an artefact, then the PAD score stating it is a presentation attack is assigned to the index finger.)
- A message conforming to TR-03121 XML containing the encoded fingerprint images is returned via the test interface (`bio:FingerAcquisition`).

Test Case ID: TC-PAD-FP-APP-002

<i>Evaluation</i>	<ul style="list-style-type: none"> • An artefact is considered as detected, if the device shows a PAD alarm in six out of ten attempts. • A device failed the total test, if a single artefact class never triggered a PAD alarm. • A device failed the total test, if four or more artefacts in total were not detected as stated above. • A device failed the total test, if within test step 1 more than three of the bona fide fingerprints are not recognized as bona fide. Failures of detection from the other test steps do not count for this requirement. Note that during certification a more relaxed false-alarm-rate is tested than specified within the respective Function Module. The requirement of the rate specified in the respective Function Module is tested on operational collected data only.
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Table 2.125 Test Case ID: TC-PAD-FP-APP-002

2.6 Test Cases Compression

2.6.1 Test Cases FM COM-FI-BCL

Test Case ID: TC-COM-FI-BCL-001

<i>Scope</i>	Examine the correctness of the compression of live images used within the context of border control.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded. • As necessary test resources: a test database containing multiple compressed and uncompressed (including losslessly compressed) facial images. The provided formats are BMP, PNG, JPEG and JPEG2000. • Provision of the according biometric container including the image data.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-COM-FI-BCL-001/1

Table 2.128 TC-COM-FI-BCL-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>1. Extraction of the compressed facial image file from the biometric container.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The resulting image is compressed using JPEG2000 (according to ISO/IEC 15444-1) or JPEG (according to ISO/IEC 10918-1) compression standard. • The actual file size of the compressed image is below 375 kB. • The compression level is below 1:20.

Table 2.127 Test Case ID: TC-COM-FI-BCL-001

2.6.2 Test Cases FM COM-FI-IMA

Test Case ID: TC-COM-FI-IMA-001

<i>Scope</i>	Examine the correctness of the compression of live images used within the context of immigration authorities.
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Test Case ID: TC-COM-FI-IMA-001

- Preconditions*
- IUT is running, required modules are loaded.
 - As necessary test resources: a test database containing multiple compressed and uncompressed (including losslessly compressed) facial images.
 - Provision of the according biometric container including the image data.
- CTS Mode*
- automatic
 - Image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: POST
 - test case variants:

/TR03122/TC-COM-FI-IMA-001/1

Table 2.130 TC-COM-FI-IMA-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check file size and file compression.</p> <ul style="list-style-type: none"> • Initiate test via CTS. • Verify integrity of compressed file by decoding with a standard JPEG viewer/decoder <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The resulting image is compressed using JPEG2000 (according to ISO/IEC 15444-1) or JPEG (according to ISO/IEC 10918-1) compression standard. • The actual file size of the compressed image is below 375 kB. • The compression level is below 1:20.
2	<p><i>Description:</i></p> <p>Check rejection of already compressed face images and initiate test case by loading a compressed reference image using the test interface, given standard sized images as input.</p> <p><i>Expected Result:</i></p> <p>Since multiple lossy compression is not allowed, either an error code that the acceptance conditions are not met is returned, or no additional processing is performed on the input image (i. e. the returned image is bitwise identical to the provided image).</p>

Table 2.129 Test Case ID: TC-COM-FI-IMA-001

2.6.3 Test Cases FM COM-FI-JPG

Test Case ID: TC-COM-FI-JPG-001

- Scope*
- Examine correct parametrisation of JPEG compression
- Preconditions*
- IUT is running, required modules are loaded
 - As necessary test resources: a test database containing multiple compressed and uncompressed (including losslessly compressed) facial reference images encoded in JPEG of varying resolution
 - small size (600 x 800 pixels) in the context of BCL and ARE
 - small size (622 x 800 pixels) in the context of GID
 - standard size (1200 x 1600 pixels) in the context of BCL and ARE
 - standard size (1244 x 1600 pixels) in the context of GID

Test Case ID: TC-COM-FI-JPG-001

- CTS Mode*
- automatic
 - Image provision using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: POST
 - test case variants:

/TR03122/TC-COM-FI-JPG-001/1

Table 2.132 TC-COM-FI-JPG-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check minimum file size after compression of small sized images (600 x 800 / 622 X 800 pixels)</p> <ul style="list-style-type: none"> • Initiate test case by loading a uncompressed or losslessly compressed reference facial image using the test interface, given small sized images as input • Verify integrity of compressed file by decoding with a standard JPEG viewer/decoder <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing the compressed facial image is returned via the test interface (bio:Record) • The actual file size the compressed image is greater than or equal to 35 KiB • The resolution of the compressed images remains 600 x 800 / 622 x 800 pixels • The resulting image can be decoded by a standard JPEG viewer/decoder
2	<p><i>Description:</i></p> <p>Check minimum file size after compression of standard sized images (1200 x 1600 / 1244 x 1600 pixels)</p> <ul style="list-style-type: none"> • Initiate test case by loading a uncompressed or losslessly compressed reference facial image using the test interface, given standard sized images as input • Verify integrity of compressed file by decoding with a standard JPEG viewer/decoder <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML containing the compressed facial image is returned via the test interface (bio:Record) • The actual file size of the compressed image is greater than or equal to 100 KiB • The resolution of the compressed images remains 1200 x 1600 / 1244 x 1600 pixels • The resulting images can be decoded by a standard JPEG viewer/decoder
3	<p><i>Description:</i></p> <p>Check rejection of already compressed face images</p> <ul style="list-style-type: none"> • Initiate test case by loading a compressed reference facial image using the test interface, given standard sized images as input • Verify integrity of compressed file by decoding with a standard JPEG viewer/decoder <p><i>Expected Result:</i></p> <p>As a result, a message that the acceptance conditions are not met is returned, since multiple lossy compression is not allowed.</p>

Table 2.131 Test Case ID: TC-COM-FI-JPG-001

2.6.4 Test Cases FM COM-FP-BCL

Test Case ID: TC-COM-FP-BCL-001

- Scope* Examine the correctness of the compression of fingerprint images contained in ANSI/NIST-ITL 1 files within the context of border control.
- Preconditions*
- IUT is running, required modules are loaded.
 - As necessary test resources: a test database containing multiple fingerprint and slap images.
- CTS Mode*
- automatic
 - Image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: POST
 - test case variants:

/TR03122/TC-COM-FP-BCL-001/1

Table 2.134 TC-COM-FP-BCL-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Check file size and file compression: initiate test case by loading fingerprint and slap images using the test interface.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT returns a message conforming to TR-03121 XML containing an ANSI/NIST container within type .bio.Record • The NIST file has either a maximum file size of 5332 kB (Entry-Exit System (EES) purposes) or 3000 kB (Schengen Information System (SIS) purposes).

Table 2.133 Test Case ID: TC-COM-FP-BCL-001

2.6.5 Test Cases FM COM-FP-IMA

Test Case ID: TC-COM-FP-IMA-001

- Scope* Examine the correctness of the compression of fingerprint images contained in ANSI/NIST-ITL 1 files within the context of immigration authorities.
- Preconditions*
- IUT is running, required modules are loaded.
 - As necessary test resources: a test database containing multiple fingerprint and slap images.
- CTS Mode*
- automatic
 - Image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: POST
 - test case variants:

/TR03122/TC-COM-FP-IMA-001/1

Table 2.136 TC-COM-FP-IMA-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Check file size and file compression: initiate test case by loading fingerprint and slap images using the test interface.</p>

Test Case ID: TC-COM-FP-IMA-001

Expected Result:

- The IUT returns a message conforming to TR-03121 XML containing an ANSI/NIST container within type .bio.Record
- The NIST file has either a maximum file size of 5332 kB (EES purposes) or 3000 kB (SIS purposes).

Table 2.135 Test Case ID: TC-COM-FP-IMA-001

2.6.6 Test Cases FM COM-FP-WSQ

Test Case ID: TC-COM-FP-WSQ-001

<i>Scope</i>	Examination of the size and compression format of the resulting fingerprint images.
<i>Preconditions</i>	<ul style="list-style-type: none"> • A necessary test resource: IUT with FBI certified Wavelet Scalar Quantisation (WSQ) algorithm. • A FBI certificate for the used WSQ implementation of the IUT is available • IUT is running, required modules are loaded. • As necessary test resources: a Ground Truth database for conformance test and the CTS are at hand. • The test data base contains: <ul style="list-style-type: none"> • Sequences of fingerprint images. • Corresponding Ground Truth values of WSQ compressed images with a bit-rate of 0.75.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-COM-FP-WSQ-001/1

Table 2.138 TC-COM-FP-WSQ-001 Test Case Variants

<i>Description</i>	<table border="1"> <thead> <tr> <th style="text-align: left;">Step</th> <th style="text-align: left;">Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;">1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • Committing consecutively fingerprint images for this test case from the conformance test data base. • Initiate test case by calling the IUT and providing the images via the test interface. <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record).</p> </td> </tr> <tr> <td style="vertical-align: top;">2</td> <td> <p><i>Description:</i></p> <p>Examination of the size of the WSQ image data.</p> <p><i>Expected Result:</i></p> <p>The size of the compressed WSQ image is between 1/10 and 1/20 of the original raw image.</p> </td> </tr> <tr> <td style="vertical-align: top;">3</td> <td> <p><i>Description:</i></p> <p>Examination of the software implementation value (sf) from the WSQ header of the image data and the certification of the WSQ algorithm used by the IUT.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Committing consecutively fingerprint images for this test case from the conformance test data base. • Initiate test case by calling the IUT and providing the images via the test interface. <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record).</p>	2	<p><i>Description:</i></p> <p>Examination of the size of the WSQ image data.</p> <p><i>Expected Result:</i></p> <p>The size of the compressed WSQ image is between 1/10 and 1/20 of the original raw image.</p>	3	<p><i>Description:</i></p> <p>Examination of the software implementation value (sf) from the WSQ header of the image data and the certification of the WSQ algorithm used by the IUT.</p>
Step	Description / Expected Result								
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Committing consecutively fingerprint images for this test case from the conformance test data base. • Initiate test case by calling the IUT and providing the images via the test interface. <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record).</p>								
2	<p><i>Description:</i></p> <p>Examination of the size of the WSQ image data.</p> <p><i>Expected Result:</i></p> <p>The size of the compressed WSQ image is between 1/10 and 1/20 of the original raw image.</p>								
3	<p><i>Description:</i></p> <p>Examination of the software implementation value (sf) from the WSQ header of the image data and the certification of the WSQ algorithm used by the IUT.</p>								

Test Case ID: TC-COM-FP-WSQ-001

4	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The sf value in the WSQ header is not 0. • The sf value is referenced in the FBI certificate for the WSQ implementation of the module. • The WSQ implementation is certified by the FBI. • The WSQ implementation of the module is version 3.1 and based on NBIS Version 5.0. <p><i>Description:</i></p> <p>Examination of the resulting format of the images (decode image data from the biometric container using a certified WSQ implementation).</p> <p><i>Expected Result:</i></p> <p>All returned fingerprint images can be decoded with the WSQ algorithm.</p>
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Table 2.137 Test Case ID: TC-COM-FP-WSQ-001

2.6.7 Test Cases FM COM-FP-WSQE

Test Case ID: TC-COM-FP-WSQE-001

<i>Scope</i>	Examination of the size and compression format of the resulting fingerprint images
<i>Preconditions</i>	<ul style="list-style-type: none"> • A necessary test resource: IUT with FBI certified WSQ algorithm • IUT is running, required modules are loaded • As necessary test resources: a Ground Truth database for conformance test and the CTS are at hand • The test data base contains: <ul style="list-style-type: none"> • Sequences of fingerprint images • Corresponding Ground Truth values of WSQ compressed images with a bit-rate of 0.75 • Image provision using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")
<i>CTS Mode</i>	<ul style="list-style-type: none"> • automatic • Image provision using the test interface (see BSI TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-COM-FP-WSQE-001/1	Examination of the WSQ 3.0 compatibility
/TR03122/TC-COM-FP-WSQE-001/2	Examination of the WSQ 3.1 compatibility

Table 2.140 TC-COM-FP-WSQE-001 Test Case Variants

<i>Description</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 5px;">Step</th> <th style="text-align: left; padding: 5px;">Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top; padding: 5px;">1</td> <td style="padding: 5px;"> <p><i>Description:</i></p> <p>Committing consecutively fingerprint images for this test case from the conformance test data base</p> <p>Initiate test case by calling the IUT and providing the images via the test interface</p> <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record)</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Committing consecutively fingerprint images for this test case from the conformance test data base</p> <p>Initiate test case by calling the IUT and providing the images via the test interface</p> <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record)</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Committing consecutively fingerprint images for this test case from the conformance test data base</p> <p>Initiate test case by calling the IUT and providing the images via the test interface</p> <p><i>Expected Result:</i></p> <p>As a result, for every input sequence a message conforming to TR-03121 XML containing the compressed fingerprint images is returned via the test interface (bio:Record)</p>				

Test Case ID: TC-COM-FP-WSQE-001

2	<p><i>Description:</i></p> <p>Examination of the size of the WSQ image data</p> <p><i>Expected Result:</i></p> <p>The size of the compressed WSQ image is between 1/10 and 1/20 of the original raw image.</p>
3	<p><i>Description:</i></p> <p>Examination of the software implementation value (sf) from the WSQ header of the image data</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The sf value in the WSQ header is not equal 0 • The sf value is referenced in the FBI certificate for the WSQ implementation of the module
4	<p><i>Description:</i></p> <p>Examination of the resulting format of the images (decode image data from the biometric container using a certified WSQ implementation)</p> <p><i>Expected Result:</i></p> <p>All returned fingerprint images can be decoded with the WSQ algorithm.</p>

Table 2.139 Test Case ID: TC-COM-FP-WSQE-001**Test Case ID: TC-COM-FP-WSQE-002**

<i>Scope</i>	Examination of the certification of the WSQ algorithm used by the IUT.				
<i>Preconditions</i>	An FBI certificate for the used WSQ implementation of the IUT is available				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Check of the FBI certificate of the used WSQ implementation</p> <p><i>Expected Result:</i></p> <p>The WSQ implementation is certified by the FBI.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Check of the FBI certificate of the used WSQ implementation</p> <p><i>Expected Result:</i></p> <p>The WSQ implementation is certified by the FBI.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Check of the FBI certificate of the used WSQ implementation</p> <p><i>Expected Result:</i></p> <p>The WSQ implementation is certified by the FBI.</p>				

Table 2.141 Test Case ID: TC-COM-FP-WSQE-002

2.6.8 Test Cases FM COM-FP-WSQR

Test Case ID: TC-COM-FP-WSQR-001

<i>Scope</i>	Examination of the size and compression format of the resulting fingerprint images				
<i>Preconditions</i>	<ul style="list-style-type: none"> • A necessary test resource: IUT with FBI certified WSQ algorithm • The FBI certificate is at hand • IUT is running, required modules are loaded • Acquisition of a fingerprint with the IUT 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Extraction of the compressed facial image file from the biometric container</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Extraction of the compressed facial image file from the biometric container</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Extraction of the compressed facial image file from the biometric container</p>				

Test Case ID: TC-COM-FP-WSQR-001

Expected Result:

- The size of the compressed WSQ image is smaller than or equal to 18 kB.
- The sf value in the WSQ header is not equal 0
- The sf value is referenced in the FBI certificate for the WSQ implementation of the module
- All returned fingerprint images can be decoded with the WSQ algorithm

Table 2.142 Test Case ID: TC-COM-FP-WSQR-001

2.7 Test Cases User Interface

2.7.1 Test Cases FM UI-FI-BSJ

Test Case ID: TC-UI-FI-BSJ-001

Scope Note that the requirement of presence of a feedback screen depends on the application context. If the acquisition system is required to have a feedback screen for the facial image acquisition within the specific application context in question, or if the vendor decided to implement a feedback screen although it is not mandatory in the specific application context in question, the feedback screen shall be examined according to the following specifications:

Examination of availability of feedback screen, digital mirror or physical mirror image and user guidance in the user interface shown to the biometric subject during facial image acquisition.

Preconditions

- The IUT is in operation, required modules are loaded.
- The integrated camera system used in the specific application scenario is connected.
- The IUT implements a user interface of facial image acquisition shown to the biometric subject.
- The IUT is able to display a digital mirror or physical mirror image and information for guidance to help the biometric subject with the correct positioning.
- The acquisition system is required by another Function Module to have a feedback screen for the facial acquisition
- Fake facial images (e.g. created with a 3D-printer) are available as necessary test resource.

CTS Mode

Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>A biometric subject performs a compliant face presentation in the IUT's capture area.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A digital mirror or physical mirror image is shown by the IUT for guidance to help the biometric subject with the correct positioning. • A compliant facial image is acquired.
2	<p><i>Description:</i></p> <p>A biometric subject performs a non-compliant face presentation in the IUT's capture area where positional requirements are not met.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A digital mirror or physical mirror image is shown by the IUT for guidance to help the biometric subject with the correct positioning. • The IUT displays user guidance information to help the biometric subject with the correct positioning in front of the camera. • The facial image acquisition is omitted by the IUT.

Test Case ID: TC-UI-FI-BSJ-001

3	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A biometric subject initially performs a non-compliant face presentation in the IUT's capture area where positional requirements are not met. • The biometric subject follows the user guidance information provided by the IUT until a compliant face presentation is performed where positional requirements are met. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A digital mirror or physical mirror image is shown by the IUT for guidance to help the biometric subject with the correct positioning. • A compliant facial image is acquired.
4	<p><i>Description:</i></p> <p>A biometric subject initially performs a facial image presentation attack in the IUT's capture area.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A facial image is captured and the resulting image is displayed by the IUT. • Both the PAD result and the PAD score are only displayed to the operator. Neither the PAD result nor the PAD score are displayed to the biometric subject.

Table 2.143 Test Case ID: TC-UI-FI-BSJ-001

2.7.2 Test Cases FM UI-FI-OP

Test Case ID: TC-UI-FI-OP-001

<i>Scope</i>	Examination of the correct user interface for facial images with sufficient quality				
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • If the IUT does not provide a graphical user interface (e.g. it is implemented as a library), a rudimentary example user interface has to be provided for evaluation purposes 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td> <p><i>Description:</i></p> <p>An image with sufficient quality is captured using the IUT.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Any relevant quality criteria is displayed in the GUI (each resulting in OK) • The overall quality is indicated visually by the IUT (OK) • The IUT provides the option to put in veto before release of the image (veto is put in via UI, i.e. image is rejected despite positive Quality Assessment (QA) result computed by IUT) • The IUT provides a warning message to the operator if PAD was performed and a presentation attack was detected. All facial images that have caused a PAD alarm SHALL be displayed to the operator as well. In addition, all facial images within an acquisition where at least one facial image caused a PAD alarm SHALL be displayed to the operator. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>An image with sufficient quality is captured using the IUT.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Any relevant quality criteria is displayed in the GUI (each resulting in OK) • The overall quality is indicated visually by the IUT (OK) • The IUT provides the option to put in veto before release of the image (veto is put in via UI, i.e. image is rejected despite positive Quality Assessment (QA) result computed by IUT) • The IUT provides a warning message to the operator if PAD was performed and a presentation attack was detected. All facial images that have caused a PAD alarm SHALL be displayed to the operator as well. In addition, all facial images within an acquisition where at least one facial image caused a PAD alarm SHALL be displayed to the operator.
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>An image with sufficient quality is captured using the IUT.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Any relevant quality criteria is displayed in the GUI (each resulting in OK) • The overall quality is indicated visually by the IUT (OK) • The IUT provides the option to put in veto before release of the image (veto is put in via UI, i.e. image is rejected despite positive Quality Assessment (QA) result computed by IUT) • The IUT provides a warning message to the operator if PAD was performed and a presentation attack was detected. All facial images that have caused a PAD alarm SHALL be displayed to the operator as well. In addition, all facial images within an acquisition where at least one facial image caused a PAD alarm SHALL be displayed to the operator. 				

Table 2.144 Test Case ID: TC-UI-FI-OP-001**Test Case ID: TC-UI-FI-OP-002**

<i>Scope</i>	Examination of the correct user interface for facial images with insufficient quality.
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Test Case ID: TC-UI-FI-OP-002

Preconditions

- IUT is running, required modules are loaded
- If the IUT does not provide a graphical user interface (e.g. it is implemented as a library), a rudimentary example user interface has to be provided for evaluation purposes

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>An image with insufficient quality is captured using the IUT e.g. the eye are closed test person closes the eyes and rotates the head.</p> <p>Initiate test case calling the IUT via the test interface</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Any relevant quality criteria is displayed in the GUI (at least one resulting in NOK) • The overall quality is indicated visually by the IUT (NOK) • The cause for the negative overall quality assessment is displayed • The IUT provides the option to put in veto before release of the image (veto is put in via UI, i.e. image is accepted despite negative QA result computed by IUT) • The IUT provides a warning message to the operator if PAD was performed and a presentation attack was detected. All facial images that have caused a PAD alarm SHALL be displayed to the operator as well. In addition, all facial images within an acquisition where at least one facial image caused a PAD alarm SHALL be displayed to the operator.

Table 2.145 Test Case ID: TC-UI-FI-OP-002

2.7.3 Test Cases FM UI-FP-BSJ

Test Case ID: TC-UI-FP-BSJ-001

Scope Examination of availability of real-time feedback and user guidance in the user interface shown to the biometric subject during fingerprint acquisition.

Preconditions

- The IUT is in operation, required modules are loaded.
- The fingerprint scanner used in the specific application scenario is connected.
- The IUT implements a user interface of fingerprint acquisition shown to the biometric subject.
- The IUT is able to display feedback and information for guidance to help the biometric subject with the correct positioning.
- Fake fingerprints (e.g. made of silicone) are available as necessary test resource.

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A digital feedback is shown by the IUT in real-time including the acquisition process status and guidance to help the biometric subject with the fingerprint selection and correct positioning. • A compliant fingerprint image is acquired.
2	<p><i>Description:</i></p> <p>A biometric subject performs a non-compliant fingerprint presentation on the IUT's fingerprint scanner where positional requirements are not met.</p>

Test Case ID: TC-UI-FP-BSJ-001

	<i>Expected Result:</i>
	<ul style="list-style-type: none"> • A digital feedback is shown by the IUT in real-time including the acquisition process status and guidance to help the biometric subject with the fingerprint selection and correct positioning. • The IUT displays user guidance information to help the biometric subject with the correct positioning on the sensor. • The fingerprint image acquisition is omitted by the IUT.
3	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A biometric subject initially performs a non-compliant fingerprint presentation on the IUT's fingerprint scanner where positional requirements are not met. • The biometric subject follows the user guidance information provided by the IUT until a compliant fingerprint presentation is performed where positional requirements are met. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A digital feedback is shown by the IUT in real-time including the acquisition process status and guidance to help the biometric subject with the fingerprint selection and correct positioning. • A compliant fingerprint image is acquired.
4	<p><i>Description:</i></p> <p>A biometric subject initially performs a fingerprint presentation attack on the IUT's fingerprint scanner.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • A fingerprint or slap image is captured and the resulting image is displayed by the IUT. • Both the PAD result and the PAD score are only displayed to the operator. Neither the PAD result nor the PAD score are displayed to the biometric subject.

Table 2.146 Test Case ID: TC-UI-FP-BSJ-001

2.7.4 Test Cases FM UI-FP-OP

Test Case ID: TC-UI-FP-OP-001

<i>Scope</i>	Examination of the correct user interface for capturing fingerprints.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The fingerprint scanner used in the specific application scenario is connected. • The IUT implements a user interface of fingerprint acquisition shown to the biometric subject. • The IUT is able to display a digital feedback and information for guidance to help the biometric subject with the correct positioning. • If the IUT does not provide a graphical user interface (e.g. it is implemented as a library), a rudimentary example user interface has to be provided for evaluation purposes. 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="0"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner.</p>				

Test Case ID: TC-UI-FP-OP-001

Expected Result:

- Guidance to help the biometric subject with the fingerprint selection and correct positioning is shown by the IUT.
- Visual feedback of the actual fingerprints is given by the IUT (at least by displaying the resulting captured images).
- The IUT provides the following information to the operator:
 - Visual feedback of all segmented fingerprints.
 - Feedback on the quality level of captured fingerprints.
 - A warning message if a slap acquisition is in place, a slap classifier is in use and the classification result mismatches with the expected slap of the current acquisition.
 - A warning message if PAD was performed and a presentation attack was detected (for each finger individually and in form of an overall result).
- The IUT provides veto power for the operator for the enrolment.

2

Description:

A biometric subject performs a non-compliant fingerprint presentation on the IUT's fingerprint scanner.

Expected Result:

- Guidance to help the biometric subject with the fingerprint selection and correct positioning is shown by the IUT.
- Visual feedback of the actual fingerprints is given by the IUT (at least by displaying the resulting captured images).
- The IUT provides the following information to the operator:
 - Visual feedback of all segmented fingerprints.
 - Feedback on the quality level of captured fingerprints.
 - A warning message if a slap acquisition is in place, a slap classifier is in use and the classification result mismatches with the expected slap of the current acquisition.
 - A warning message if PAD was performed and a presentation attack was detected (for each finger individually and in form of an overall result).
- The IUT provides veto power for the operator for the enrolment.

Table 2.147 Test Case ID: TC-UI-FP-OP-001

Test Case ID: TC-UI-FP-OP-002

<i>Scope</i>	Examination of the correct user interface for capturing fingerprints if a uniqueness check error occurs.		
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The fingerprint scanner used in the specific application scenario is connected. • The IUT implements a user interface of fingerprint acquisition shown to the biometric subject. • If the IUT does not provide a graphical user interface (e.g. it is implemented as a library), a rudimentary example user interface has to be provided for evaluation purposes. 		
<i>CTS Mode</i>	Not supported		
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> </tbody> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-UI-FP-OP-002

1	<p><i>Description:</i></p> <p>A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner.</p> <p>The biometric subject performs a fingerprint presentation on the IUT's fingerprint scanner using the same finger for a different finger position.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT displays a warning message that a uniqueness check error was detected. • The fingers involved in the unexpected successful comparisons SHALL be pictorially displayed to the operator.
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Table 2.148 Test Case ID: TC-UI-FP-OP-002

2.7.5 Test Cases FM UI-FP-VER

Test Case ID: TC-UI-FP-VER-001

<i>Scope</i>	Examination of availability of user interface for operator during fingerprint verification.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • The fingerprint scanner used in the specific application scenario is connected. • The IUT implements a user interface of fingerprint acquisition shown to the operator. • The IUT is able to display a visual feedback of the fingerprint verification to the operator.
<i>CTS Mode</i>	Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A biometric subject performs a compliant fingerprint presentation on the IUT's fingerprint scanner. • Depending on the used scanner a compliant presentation of a single finger, multiple fingers or slap is conducted, respectively. <p><i>Expected Result:</i></p> <p>A compliant fingerprint image is acquired.</p>
2	<p><i>Description:</i></p> <p>The operator initiates a fingerprint verification process.</p> <p><i>Expected Result:</i></p> <p>A visual feedback about the result of the verification process is shown by the IUT to the operator.</p>

Table 2.149 Test Case ID: TC-UI-FP-VER-001

2.8 Test Cases Biometric Comparison

2.8.1 Test Cases FM CMP-FI-GENERIC

Test Case ID: TC-CMP-FI-GENERIC-001

<i>Scope</i>	Examination of the configured security level for biometric comparison		
<i>Preconditions</i>	The vendor of the biometric comparison algorithm provides the documentation for his system which gives information about the implemented facial image identification algorithms.		
<i>CTS Mode</i>	Not supported		
<i>Description</i>	<table> <thead> <tr> <th style="text-align: center;">Step</th> <th style="text-align: center;">Description / Expected Result</th> </tr> </thead> <tbody> </tbody> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-CMP-FI-GENERIC-001

1

Description:

Examination of the documentation provided by the vendor of the identification algorithm.

Expected Result:

- The documentation gives evidence that the comparison algorithms achieve one of the following operating points:
 - A maximum false-positive-identification-rate (FPIR) of 1 % and a false-negative-identification-rate (FNIR) below 2,5 %
 - or
 - a maximum FPIR of 0.1 % and a FNIR below 5 %.
 - or
 - a maximum FPIR of 0.01 % and a FNIR below 10 %.
- The claims stated above are supported by test results for a series of tests performed on a database which is of similar size and characteristics as the one been used in the current application scenario.
- Information about the data used for the calibration of the algorithm is provided, especially
 - the size and image characteristics of the database which was used for training the algorithm is stated.
 - the conversion routine between raw scores and threshold defined by False Positive Identification Rate is stated.
- The documentation states that the system also provides a list of potential matches for which their respective score exceeds the thresholds configured for the system. The documentation gives proof that the maximum size of this list can be configured.
- The documentation gives evidence that the comparison algorithm can be calibrated for different use cases, especially higher FPIR values in case of watchlist comparison scenarios.

Table 2.150 Test Case ID: TC-CMP-FI-GENERIC-001**2.8.2 Test Cases FM CMP-FI-VER****Test Case ID: TC-CMP-FI-VER-001**

<i>Scope</i>	Examination of the configured security level for biometric comparison.	
<i>Preconditions</i>	The vendor of the biometric comparison algorithm provides a documentation which gives information about the working point of the comparison algorithm.	
<i>CTS Mode</i>	Not supported	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Examination of the documentation provided by the vendor of the comparison algorithm.</p>

Test Case ID: TC-CMP-FI-VER-001*Expected Result:*

- The documentation gives information (typically a Detection Error Trade-Off (DET) curve) of the performance of the algorithm based on a data.
- The documentation gives evidence that the comparison algorithm ensures a working point of a maximum false-match-rate (FMR) of 0.1 % and a false-non-match-rate (FNMR) below 2 %. Stronger settings are allowed (lower FMR and/or FNMR).
- The documentation gives evidence that the comparison algorithm can be calibrated for the security level set within this specific scenario of verification.

Table 2.151 Test Case ID: TC-CMP-FI-VER-001

2.8.3 Test Cases FM CMP-FP-CC

Test Case ID: TC-CMP-FP-CC-001

<i>Scope</i>	Examination of the configured security level for biometric comparison				
<i>Preconditions</i>	The vendor of the biometric comparison algorithm provides a documentation which gives information about the operating point of the comparison algorithm				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Examination of the documentation provided by the vendor of the comparison algorithm</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The documentation gives information (typically a DET curve) of the performance of the algorithm based on a reference database. • The documentation gives evidence that the comparison algorithm ensures an operating point of a maximum false match rate (FMR) of 0.1 % and a false non-match rate (FNMR) below 2 %. • The documentation gives evidence that the comparison algorithm can be calibrated for the security level set within this specific scenario of verification. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Examination of the documentation provided by the vendor of the comparison algorithm</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The documentation gives information (typically a DET curve) of the performance of the algorithm based on a reference database. • The documentation gives evidence that the comparison algorithm ensures an operating point of a maximum false match rate (FMR) of 0.1 % and a false non-match rate (FNMR) below 2 %. • The documentation gives evidence that the comparison algorithm can be calibrated for the security level set within this specific scenario of verification.
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Examination of the documentation provided by the vendor of the comparison algorithm</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The documentation gives information (typically a DET curve) of the performance of the algorithm based on a reference database. • The documentation gives evidence that the comparison algorithm ensures an operating point of a maximum false match rate (FMR) of 0.1 % and a false non-match rate (FNMR) below 2 %. • The documentation gives evidence that the comparison algorithm can be calibrated for the security level set within this specific scenario of verification. 				

Table 2.152 Test Case ID: TC-CMP-FP-CC-001**Test Case ID: TC-CMP-FP-CC-002**

<i>Scope</i>	Examination of proper crossmatching functionality of plain and rolled fingerprints
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A multi fingerprint scanner is connected • As necessary test resources: a test person to perform the fingerprint acquisition with • IUT is configured to perform the identification process including following steps <ul style="list-style-type: none"> • Manual acquisition of ten plain fingerprints using the IUT • Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static dummy values by IUT, so that the process can be finalized and the resulting data is returned by IUT as GSAT3 XML

Test Case ID: TC-CMP-FP-CC-002

- CTS Mode*
- interactive
 - no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: GET
 - test case variants:

/TR03122/TC-CMP-FP-CC-002/1

Table 2.154 TC-CMP-FP-CC-002 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check IUT correct behaviour of a mated crossmatching</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Capture 10 fingerprints, each fingerprint plain and rolled (in identical, mated order) • Resulting in a total of 10 captured fingerprint pairs (plain, rolled) of identical fingerprints <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML is returned via the test interface (element <code>bio:FingerAcquisition</code>, including information on the capture and crossmatching results) • The IUT returns a comparison score per pair of prints and each finger and a result of each verification (element <code>bio:ControlVerification</code>) • Each single comparison score is above the threshold and each verification result is positive
2	<p><i>Description:</i></p> <p>Check IUT correct behaviour of a non-mated crossmatching</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Capture 10 fingerprints, each fingerprint rolled and plain (non-mated, e.g. by applying fingerprints of a second person or permuting fingers) • Resulting in a total of 10 captured pairs (rolled, plain) of distinct fingerprints <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, a message conforming to TR-03121 XML is returned via the test interface (element <code>bio:FingerAcquisition</code>, including information on the capture and crossmatching results) • The IUT returns a comparison score per pair of prints and each finger and a result of each verification (element <code>bio:ControlVerification</code>) • Non-mated crossmatchings (distinct fingers) yield a comparison score below the threshold and a negative verification result

Table 2.153 Test Case ID: TC-CMP-FP-CC-002

2.8.4 Test Cases FM CMP-FP-VER

Test Case ID: TC-CMP-FP-VER-001

<i>Scope</i>	Examination of the configured security level for biometric comparison.		
<i>Preconditions</i>	The vendor of the biometric comparison algorithm provides a documentation which gives information about the working point of the comparison algorithm.		
<i>CTS Mode</i>	Not supported		
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-CMP-FP-VER-001

1	<p><i>Description:</i></p> <p>Examination of the documentation provided by the vendor of the comparison algorithm.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The documentation gives information (typically a DET curve) of the performance of the algorithm based on a data. • The documentation gives evidence that the comparison algorithm ensures a working point of a maximum FMR of 0.1 % and a FNMR below 2 %. Stronger settings are allowed (lower FMR and/or FNMR). • The documentation gives evidence that the comparison algorithm can be calibrated for the security level set within this specific scenario of verification.
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Table 2.155 Test Case ID: TC-CMP-FP-VER-001

2.9 Test Cases Logging

2.9.1 Test Cases FM LOG-ALL-GENERIC

Test Case ID: TC-LOG-ALL-GENERIC-001

<i>Scope</i>	Examination of correct syntax and semantics for the logging of information regarding generic processes and transactions.	
<i>Preconditions</i>	<ul style="list-style-type: none"> • Five sets of logging data (encoded as XML) each, e.g. produced by performing five deviating processes using IUT • The performed steps for each log data set are documented. • TR-03121 XML schema definition files and documentation. • Vendor specific documentation for error codes and further information. 	
<i>CTS Mode</i>	File based	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "trbio5v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
	2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p>

Test Case ID: TC-LOG-ALL-GENERIC-001*Expected Result:*

- Each log file contains at least one element of type `.transaction`.
- The transaction UUIDs are globally unique.
- The value of `Location` is compliant to the semantic of the relevant profile.
- If this transaction is dependent or derived from another transaction, the `TransactionReference` is set to the corresponding transaction UUID.
- In case of any abnormal termination of the transaction or any of its sub-processes, the `ErrorCode` is set.
- Each during the transaction performed enrolment process is represented by an `Enrolment` element.
 - If a central system replies directly with enrolment statuses information, the `SubmitTime` is set.
 - A `ControlVerification` element is logged for any control verification performed during the enrolment process.
- Each during the transaction performed identification process is represented by an `Identification` element.

If a central system provides detailed scoring information, the list of candidates is contained.
- Each during the transaction performed verification process is represented by a `Verification` element.
 - All performed comparisons are logged.
 - For each comparison the vendor specific score as well as the threshold are logged.

Table 2.156 Test Case ID: TC-LOG-ALL-GENERIC-001**Test Case ID: TC-LOG-ALL-GENERIC-002**

Scope Examination of error code list for abnormal termination.

Preconditions Error code list for IUT is at hand.

CTS Mode Not supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check availability of detailed error code list.</p> <p><i>Expected Result:</i></p> <p>A detailed list of error codes used with complete semantic descriptions is available for any error code in case of abnormal termination of the transaction or any of its sub-processes.</p>

Table 2.157 Test Case ID: TC-LOG-ALL-GENERIC-002

2.9.2 Test Cases FM LOG-ALL-ARE

Test Case ID: TC-LOG-ALL-ARE-001

Scope Examination of correct syntax and semantics for the logging of information in the context of alien register enrolment.

Test Case ID: TC-LOG-ALL-ARE-001

- Preconditions*
- Five sets of logging data (encoded as XML) containing are-log elements are available.
 - Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to:
 - Bona-fide acquisition of at least one modality with fulfilled quality criteria.
 - Acquisition of at least one modality with unfulfilled quality criteria.
 - Cancelled acquisition process.
 - Rejected image acquisition result via veto by operator and repeated acquisition.
 - Failed acquisition process based on incorrect behaviour of the biometric subject.
 - The performed steps for each log data set are documented.
 - TR-03121 XML schema definition files and documentation are at hand.

CTS Mode

File based

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "are5v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The process flow and information described by the contents of the log file matches the actually performed process using the IUT. • If information about existing facial images of the applicant exist in the CIR, the number of images, whether an acceptable image is available and whether any of the acceptable image was used are logged. • Details for each performed control verification are stored. • The name of the city or village where the biometric process takes place is set as Location.

Table 2.158 Test Case ID: TC-LOG-ALL-ARE-001

2.9.3 Test Cases FM LOG-ALL-BCL

Test Case ID: TC-LOG-ALL-BCL-001

Scope Examination of correct syntax and semantics for the logging of information in the context of border control.

- Preconditions*
- Five sets of logging data (encoded as XML) containing bc1-log elements are available.
 - Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to:
 - Bona-fide acquisition of at least one modality with fulfilled quality criteria.
 - Acquisition of at least one modality with unfulfilled quality criteria.
 - Cancelled acquisition process.
 - Rejected image acquisition result via veto by operator and repeated acquisition.
 - Failed acquisition process based on incorrect behaviour of the biometric subject.
 - The performed steps for each log data set are documented.
 - TR-03121 XML schema definition files and documentation are at hand.

CTS Mode

File based

Test Case ID: TC-LOG-ALL-BCL-001

Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "bcl5v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
	2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The process flow and information described by the contents of the log file matches the actually performed process using the IUT. • For externally stored images the embedded type .data .record elements refer to the image via the attribute externalReference and furthermore do not contain Data elements.

Table 2.159 Test Case ID: TC-LOG-ALL-BCL-001

2.9.4 Test Cases FM LOG-ALL-GID

Test Case ID: TC-LOG-ALL-GID-001

<i>Scope</i>	Examination of correct syntax and semantics for the logging of information in the context of identity documents.	
<i>Preconditions</i>	<ul style="list-style-type: none"> • Five sets of logging data (encoded as XML) containing gid-log elements are available. • Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to: <ul style="list-style-type: none"> • Bona-fide acquisition of at least one modality with fulfilled quality criteria. • Acquisition of at least one modality with unfulfilled quality criteria. • A transaction for a biometric subject with legal basis to take fingerprints. • A transaction for a biometric subject with legal basis to take fingerprints where no fingerprints could be captured. • A transaction for a biometric subject without a legal basis to take fingerprints (i.e. under age). • The performed steps for each log data set are documented. • TR-03121 XML schema definition files and documentation are at hand. • Note: If the IUT is a biometric component only, this test case shall not be applied as the relevant data are not acquired by the IUT itself. 	
<i>CTS Mode</i>	File based	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "gid5v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
	2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p>

Test Case ID: TC-LOG-ALL-GID-001*Expected Result:*

- Information whether fingerprint are legally allowed to be captured are represented by `FingerprintCaptureAllowed`.
- If there was no legal basis to take fingerprints, the information is set to `false` and no fingerprint images are contained.
- If there was a legal basis to take fingerprints for a person without fingers or hands, the information is set to `true`.
- The element `Location` contains the "Behördenkennziffer".

Table 2.160 Test Case ID: TC-LOG-ALL-GID-001

2.9.5 Test Cases FM LOG-ALL-IMA

Test Case ID: TC-LOG-ALL-IMA-001

Scope Examination of correct syntax and semantics for the logging of information in the context of border control.

Preconditions

- Five sets of logging data (encoded as XML) containing `ima-log` elements are available.
- Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to:
 - bona-fide acquisition of at least one modality with fulfilled quality criteria
 - acquisition of at least one modality with unfulfilled quality criteria
 - cancelled acquisition process
 - rejected image acquisition result via veto by operator and repeated acquisition
 - failed acquisition process based on incorrect behaviour of the subject.
- The performed steps for each log data set are documented.
- TR-03121 XML schema definition files and documentation are at hand.

CTS Mode File based

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "<code>trbio5v1.xsd</code>".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The process flow and information described by the contents of the log file matches the actually performed process using the IUT. • The element <code>ApplicationProfile</code> is filled with a valid application profile of volume IMA.

Table 2.161 Test Case ID: TC-LOG-ALL-IMA-001

2.9.6 Test Cases FM LOG-FI-GENERIC

Test Case ID: TC-LOG-FI-GENERIC-001

Scope Examination of correct syntax and semantics for the logging of information regarding generic facial image acquisitions.

Test Case ID: TC-LOG-FI-GENERIC-001

- Preconditions*
- Five sets of logging data (encoded as XML) containing `FaceAcquisition` elements are available.
 - Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to:
 - Bona-fide facial image acquisition with fulfilled quality criteria.
 - Facial image acquisition with unfulfilled quality criteria.
 - Cancelled acquisition process.
 - Rejected image acquisition result via veto by operator and repeated acquisition. (This is not applicable to self-service systems.)
 - Failed acquisition process based on incorrect behaviour of the biometric subject.
 - The performed steps for each log data set are documented.
 - TR-03121 XML schema definition files and documentation are at hand.

CTS Mode

File based

*Description***Step** **Description / Expected Result**

1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "<code>trbio5v1.xsd</code>".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • For each performed capture a <code>FaceCapture</code> element exists. • If a veto was put by the operator, the type of veto is logged. • Quality information are provided at least for the selected capture. • For each quality criterion the identifier, upper and lower value bound as well as the upper and lower threshold are logged. • If more than one <code>FaceCapture</code> element exists, the <code>capture</code> attribute references the related capture within each <code>FaceQuality</code> element. • The quality values are logged for each performed PAD. • If an user interface was available during the face acquisition, the displayed information are stored in an <code>UserInterface</code> element.

Table 2.162 Test Case ID: TC-LOG-FI-GENERIC-001

2.9.7 Test Cases FM LOG-FI-BCL

Test Case ID: TC-LOG-FI-BCL-001

Scope Examination of correct syntax and semantics for the logging of facial image acquisitions information in the context of border control.

Test Case ID: TC-LOG-FI-BCL-001

- Preconditions*
- Five sets of logging data (encoded as XML) containing bc1-log elements are available.
 - Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to:
 - Bona-fide acquisition of at least one modality with fulfilled quality criteria.
 - Acquisition of at least one face image with unfulfilled quality criteria.
 - Cancelled acquisition process.
 - Rejected image acquisition result via veto by operator and repeated acquisition.
 - Failed acquisition process based on incorrect behaviour of the biometric subject.
 - The performed steps for each log data set are documented.
 - TR-03121 XML schema definition files and documentation are at hand.

CTS Mode

File based

*Description***Step** **Description / Expected Result**

- | | |
|---|--|
| 1 | <p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "bc15v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p> |
| 2 | <p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The process flow and information described by the contents of the log file matches the actually performed process using the IUT. • For each performed PAD the detailed PAD quality values are logged. |

Table 2.163 Test Case ID: TC-LOG-FI-BCL-001

2.9.8 Test Cases FM LOG-FI-GID

Test Case ID: TC-LOG-FI-GID-001*Scope* Check of consistency of logged values

- Preconditions*
- Scanning of application form or capturing of the facial image and provision of a selected single image
 - Provision of the according biometric container including the image data

*Description***Step** **Description / Expected Result**

- | | |
|---|---|
| 1 | <p><i>Description:</i></p> <p>Examination of relation of the range and/or tolerance if values are available</p> <p><i>Expected Result:</i></p> <p>If min, max, tmin or tmax are present the following relation has to be valid:
min<=tmin<=tmax<=max</p> |
| 2 | <p><i>Description:</i></p> <p>Examination of the XML Logging</p> |

Test Case ID: TC-LOG-FI-GID-001

Expected Result:

- The XML-element FaceAcquisition and/or FaceAcquisition MAY exist multiple times (including their Records/BinaryRecord children).
-
- The XML-element FaceAcquisition/Records/BinaryRecord/@type and/or FaceDelivery/Records/BinaryRecord/@type is jpeg when coming from a face acquisition or delivery process.
- The XML-element FaceAcquisition/Records/BinaryRecord/BinaryData/Value or FaceDelivery/Records/BinaryRecord/BinaryData/Value occurs exactly once before being sent to document production after the selection procedure. The output image fulfills the requirements to be sent to the document production (e.g. FaceAcquisition/Records/BinaryRecord/@type or FaceDelivery/Records/BinaryRecord/@type is jpeg2000). All other binary data values of face deliveries or acquisitions have been deleted. However, multiple appearances of these elements are permitted before being fed to the selection procedure (e.g. from any acquisition or delivery application).
- Neither the XML-element FaceAcquisition/Records/XMLRecord nor the XML-element FaceDelivery/Records/XMLRecord is used.

Table 2.164 Test Case ID: TC-LOG-FI-GID-001

2.9.9 Test Cases FM LOG-FP-GENERIC

Test Case ID: TC-LOG-FP-GENERIC-001

<i>Scope</i>	Examination of correct syntax and semantics for the logging of generic fingerprint information.
<i>Preconditions</i>	<ul style="list-style-type: none"> • Five sets of logging data (encoded as XML) containing FingerAcquisition elements are available. • Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to: <ul style="list-style-type: none"> • Bona-fide acquisition of at least one modality with fulfilled quality criteria. • Acquisition of at least one fingerprint with unfulfilled quality criteria. • Cancelled acquisition process. • Fingerprint acquisitions with missing fingers or slaps. • Failed acquisition process based on incorrect behaviour of the biometric subject. • The performed steps for each log data set are documented. • TR-03121 XML schema definition files and documentation are at hand.
<i>CTS Mode</i>	File based
<i>Description</i>	

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Validate each log file against the TR-03121 schema definition "trbio5v1.xsd".</p> <p><i>Expected Result:</i></p> <p>Each file passes the validation process without errors.</p>
2	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p>

Test Case ID: TC-LOG-FP-GENERIC-001*Expected Result:*

- The process flow and information described by the contents of the log file matches the actually performed process using the IUT.
- The reference to the corresponding record is logged if available
- For each performed PAD the detailed PAD quality values are logged.
- Details of the uniqueness check are contained if performed and duplicates are found.
- In unsupervised acquisition scenarios the surveillance information are stored and linked to the fingerprint capture attempt.
- The `MultiplePersonDetectionInformation` specifies whether multiple persons have been detected during the fingerprint acquisition process or not.
- If a slap classification is performed during the acquisition process, the details are logged as `FingerClassifierInformation`.

Table 2.165 Test Case ID: TC-LOG-FP-GENERIC-001**2.9.10 Test Cases FM LOG-FP-BCL****Test Case ID: TC-LOG-FP-BCL-001**

<i>Scope</i>	Verification of semantics of logging data and information contained therein.				
<i>Preconditions</i>	<ul style="list-style-type: none"> • At least 2 biometric subjects <p>Five sets of logging data (encoded as XML) containing <code>FingerAcquisition</code> elements are available.</p> <ul style="list-style-type: none"> • Each logging data set is produced by performing five deviating processes using the IUT, which include but are not limited to: <ul style="list-style-type: none"> • Bona-fide acquisition of at least one modality with fulfilled quality criteria. • Acquisition of at least one fingerprint with unfulfilled quality criteria. • Cancelled acquisition process. • Fingerprint acquisitions with missing fingers or slaps. • Failed acquisition process based on incorrect behaviour of the biometric subject. • The performed steps for each log data set are documented. • TR-03121 XML schema definition files and documentation are at hand. 				
<i>CTS Mode</i>	Not supported				
<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> <p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p>
Step	Description / Expected Result				
1	<p><i>Description:</i></p> <p>Verify the content of each log file and check the contained information.</p>				

Test Case ID: TC-LOG-FP-BCL-001*Expected Result:*

- The process flow and information described by the contents of the log file matches the actually performed process using the IUT.
- The reference to the corresponding record is logged if available
- For each performed PAD the detailed PAD quality values are logged.
- Details of the uniqueness check are contained if performed and duplicates are found.
- In unsupervised acquisition scenarios the surveillance information are stored and linked to the fingerprint capture attempt.
- The `MultiplePersonDetectionInformation` is specified when multiple persons have been present during the fingerprint acquisition process.
- If a slap classification is performed during the acquisition process, the details are be logged as `FingerClassifierInformation`.

Table 2.166 Test Case ID: TC-LOG-FP-BCL-001

2.9.11 Test Cases FM LOG-FP-GID

Test Case ID: TC-LOG-FP-GID-001

Scope Check of consistency of logged values

Preconditions

- Acquisition of the fingerprints of two different fingers
- Provision of the according biometric container including the image data

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>For both elements of record in <code>bio:FingerAcquisition</code>:</p> <p>Examination of the values in the field Biometric Data Block (BDB) Biometric Subtype in the Common Biometric Exchange Formats Framework (CBEFF) Header and finger position code in the finger image header</p> <p><i>Expected Result:</i></p> <p>For each record:</p> <p>the BDB Biometric Subtype contains the value for the same finger as the finger position code in the finger image header record</p>
2	<p><i>Description:</i></p> <p>For both elements record in <code>bio:FingerAcquisition</code>: Examination of the finger position code in the finger image header and for both elements <code>bio:FingerCapture</code> (or if a slap acquisition on a multifinger scanner has been performed for the one <code>bio:FingerCapture</code> with the respective two <code>bio:FingerRecordReference</code>): Examination of the value in the attribute <code>fc</code></p> <p><i>Expected Result:</i></p> <p>For both finger position codes in record there is a corresponding <code>fc</code> in <code>qa_finger</code></p>
3	<p><i>Description:</i></p> <p>Check if the fingerprint positioned on the fingerprint sensor (as demanded in the IUT graphical user interface (GUI)) is logged in the correct value in <code>fc</code> within <code>bio:FingerAcquisition</code>.</p> <p><i>Expected Result:</i></p> <p>Value of <code>fc</code> is equal to the fingerprint positioned on the fingerprint sensor</p>
4	<p><i>Description:</i></p> <p>Examination of the XML Logging</p>

Test Case ID: TC-LOG-FP-GID-001*Expected Result:*

- If the XML-element `FingerprintCaptureAllowed` is true the XML-element `FingerAcquisition` occurs at least once for applicants applying for:
 - Residence Permit
 - Passport
 - Identity Card
- The XML-element `FingerAcquisition` does not occur if the XML-element `FingerprintCaptureAllowed` is false.
- The XML-elements of `FingerAcquisition/Records/BinaryRecord` may be missing e.g. if fingers are physically impossible to acquire.
- The XML-element `FingerAcquisition/Records` occurs at maximum once in one of the `FingerAcquisition` XML-elements.
- The XML-element `FingerAcquisition/Records/XMLRecord` is not used.
- The XML-element `FingerAcquisition/Records/BinaryRecord/BinaryData/Value` occurs at least once and at maximum two times.
- The XML-element `FingerAcquisition/Records/BinaryRecord/@type` is `icao-cbeff-bit-bdb-19794-4`
- The XML-element `FingerAcquisition/Records/BinaryRecord/Data` occurs exactly once per record.

Table 2.167 Test Case ID: TC-LOG-FP-GID-001

2.10 Test Cases Coding

2.10.1 Test Cases FM COD-ALL-ARE

Test Case ID: TC-COD-ALL-ARE-001

<i>Scope</i>	Examine proper overall encoding of input data (considering biographic, biometric and transaction specific data) for identification purposes.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • A multi fingerprint scanner and facial camera is connected • IUT is configured to perform the identification process including the manual acquisition of ten plain fingerprints using the IUT • The following test resources are necessary: <ul style="list-style-type: none"> • A test person to perform the biometric acquisition with • Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static dummy values by IUT, so that the process can be finalized and the resulting data is returned by IUT as GSAT3 XML.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">/TR03122/TC-COD-ALL-ARE-001/1</div>

Table 2.169 TC-COD-ALL-ARE-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<i>Description:</i> <ul style="list-style-type: none"> • Perform the whole acquisition process using the IUT in the identification scenario with subsequent examination of returned result data

Test Case ID: TC-COD-ALL-ARE-001
Expected Result:

- The IUT delivers a response that is conformant to the schema file are5v1.xsd.
- The response contains the correct number of elements based on the XPath expression `/aad:aad-app/bio:Records/bio:XMLRecord[@type='gsat-xml']`. Exactly 1 element is expected in accordance to the acquisition process.
- The XML embedded in the element "bio:Record[@type=gsat-xml]" of the response XML is GSAT3-xml.

Table 2.168 Test Case ID: TC-COD-ALL-ARE-001

2.10.2 Test Cases FM COD-ALL-BCL

Test Case ID: TC-COD-ALL-BCL-001

<i>Scope</i>	Examine requirements and interfaces for the overall coding of biometric (facial image and fingerprints) and biographic data used within the context of border control.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • A multi fingerprint scanner and facial camera is connected • The IUT implements an interface for conformance testing where biometric data can be acquired. • The following test resources are necessary: <ul style="list-style-type: none"> • A test person to perform the biometric acquisition with • Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static and fictitious dummy values by the IUT. The goal is to focus on the encoding of biometric data so that the process can be finalized and the resulting data is returned by IUT in TR-03121 XML format, i.e. a FaceAcquisition element is returned for facial data respectively a FingerAcquisition for fingerprint data.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-COD-ALL-BCL-001/1

Table 2.171 TC-COD-ALL-BCL-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Perform the acquisition process of all desired biometric elements using the IUT with subsequent examination of returned result data <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT delivers a response that is conformant to the schema file bcl5v1.xsd. • The response contains the correct number of elements based on the XPath expression <code>/bcl:bc1-log</code>. Exactly 1 element is expected in accordance to the acquisition process. • The data encoded in the log matches the data acquired in the acquisition process.

Table 2.170 Test Case ID: TC-COD-ALL-BCL-001

2.10.3 Test Cases FM COD-ALL-GID

Test Case ID: TC-COD-ALL-GID-001

- Scope* Examine requirements and interfaces for the overall coding of biometric (facial image and fingerprints) and biographic data used within the context of German Identity Document.
- Preconditions*
- The IUT is in operation, required modules are loaded.
 - A multi fingerprint scanner and facial camera is connected
 - The IUT implements an interface for conformance testing where biometric data can be acquired.
 - The following test resources are necessary:
 - A test person to perform the biometric acquisition with
 - Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static and fictitious dummy values by the IUT. The goal is to focus on the encoding of biometric data so that the process can be finalized and the resulting data is returned by IUT in TR-03121 XML format, i.e. a FaceAcquisition element is returned for facial data respectively a FingerAcquisition for fingerprint data.
- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-COD-ALL-GID-001 / 1

Table 2.173 TC-COD-ALL-GID-001 Test Case Variants

Description	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Perform the acquisition process of all desired biometric elements using the IUT with subsequent examination of returned result data <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT delivers a response that is conformant to the schema file gid5v1.xsd. • The response contains the correct number of elements based on the XPath expression //bio:Data. Any number of elements (including none) is possible in accordance to the acquisition process. • The data encoded in the log matches the data acquired in the acquisition process.

Table 2.172 Test Case ID: TC-COD-ALL-GID-001

2.10.4 Test Cases FM COD-ALL-IMA

Test Case ID: TC-COD-ALL-IMA-001

- Scope* Examine requirements and interfaces for the overall coding of biometric (facial image and fingerprints) and biographic data used within the context of Immigration Authorities.

Test Case ID: TC-COD-ALL-IMA-001

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - All required acquisition devices, i.e. a fingerprint scanner respectively a digital camera are at hand and connected to the IUT.
 - The IUT implements an interface for conformance testing where biometric data can be acquired.
 - The following test resources are necessary:
 - A test person to perform the biometric acquisition with
 - Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static and fictitious dummy values by the IUT. The goal is to focus on the encoding of biometric data so that the process can be finalized and the resulting data is returned by IUT in TR-03121 XML format, i.e. a FaceAcquisition element is returned for facial data respectively a FingerAcquisition for fingerprint data.

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-COD-ALL-IMA-001/1

Table 2.175 TC-COD-ALL-IMA-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Perform the acquisition process of all desired biometric elements using the IUT with subsequent examination of returned result data <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT delivers a response that is conformant to the schema file ima5v1.xsd. • The response contains the correct number of elements based on the XPath expression <code>bio:FingerAcquisition//bio:Data</code>. Any number of elements (including none) is possible in accordance to the acquisition process. • The response contains the correct number of elements based on the XPath expression <code>bio:FaceAcquisition//bio:Data</code>. Any number of elements (including none) is possible in accordance to the acquisition process. • The response contains the correct number of elements based on the XPath expression <code>/ima:ima-log/bio:Records/bio:Record/bio:Data</code>. No elements are expected to appear in accordance to the acquisition process. • The data encoded in the log matches the data acquired in the acquisition process.

Table 2.174 Test Case ID: TC-COD-ALL-IMA-001

2.10.5 Test Cases FM COD-FI-GENERIC

Test Case ID: TC-COD-FI-GENERIC-001

- Scope*
- Examine requirements and interfaces for the overall coding used during the acquisition process of facial images.

Test Case ID: TC-COD-FI-GENERIC-001

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - The integrated camera system used in the specific application scenario is connected.
 - The IUT implements an interface for conformance testing where a single image can be captured.
 - The IUT is able to return the results as TR XML for every captured image via the test interface.
 - As necessary test resources: a biometric test subject whose biometric features are acquired using the IUT.
- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-COD-FI-GENERIC-001/1

Table 2.177 TC-COD-FI-GENERIC-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>In this test case a successful facial image acquisition is conducted.</p> <p>Perform the facial image acquisition process using the IUT with subsequent examination of returned result data.</p> <p>Initiate test case by calling the IUT via the test interface.</p> <p><i>Expected Result:</i></p> <p>The resulting data is encoded in an appropriate XML TR-03121 format:</p> <ul style="list-style-type: none"> • The XML data can be successfully validated against the TR-03121 XML schema definition files. • The XML data contains biometric data containers as record element only for the acquired biometric modality. • Biometric data containers are embedded as record elements within the acquisition element <code>FaceAcquisition</code>. • The contained biometric data can be successfully decoded.

Table 2.176 Test Case ID: TC-COD-FI-GENERIC-001

2.10.6 Test Case FM COD-FI-GID

Test Case ID: TC-COD-FI-GID2-001

Scope This test case checks the requirements and interfaces for the coding of facial images used for application of GID

- Preconditions*
- As necessary test resources: Facial images intended to be stored on a GID chip card.
- CTS Mode*
- not_supported

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Examine the resolution of the processed image. • Examine the aspect ratio of the processed image. • Examine the colour depth and colour space of the processed image. • Examine the encoded file format of the processed image.

Test Case ID: TC-COD-FI-GID2-001*Expected Result:*

- The resolution of the facial images is 1244 x 1600 pixels for live capture-dor delivered facial images respectively 622 x 800 pixels for scanned facial-images.
- The facial image was not upscaled and the aspect ratio of the image was kept.
- The resulting facial image is a color image (24 bit sRGB) or a grey scale image (8 bit sRGB).
- The facial images are encoded as JPEG.

Table 2.178 Test Case ID: TC-COD-FI-GID2-001**2.10.7 Test Case FM COD-FI-PRD****Test Case ID: TC-COD-FI-PRD-001**

<i>Scope</i>	This test case checks the requirements and interfaces for the coding of facial images used for document production.	
<i>Preconditions</i>	As necessary test resources: Facial images intended to be used for document production.	
<i>CTS Mode</i>	File based	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Examine the processed image, i.e.:</p> <ul style="list-style-type: none"> • the resolution of the facial image, • the colour depth and colour space, • the encoded file format of the image. <p><i>Expected Result:</i></p> <p>The facial images meet the following criteria:</p> <ul style="list-style-type: none"> • The resolution of the facial images is 622 x 800 pixels without any up-scaling. • The resulting facial image is a color image (24 bit sRGB) or a grey scale image (8 bit sRGB). • The facial images are encoded as JPEG 2000.

Table 2.179 Test Case ID: TC-COD-FI-PRD-001**2.10.8 Test Case FM COD-FI-ROD****Test Case ID: TC-COD-FI-ROR-001**

<i>Scope</i>	This test case checks the requirements and interfaces for the coding of facial images used for Register of Documents (Pass- und Personalausweisregister).	
<i>Preconditions</i>	As necessary test resources: Facial images intended to be stored Register of Documents.	
<i>CTS Mode</i>	File based	
<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Examine the processed image, i.e.:</p> <ul style="list-style-type: none"> • the resolution of the facial image, • the aspect ratio, • the colour depth and colour space, • the encoded file format of the image.

Test Case ID: TC-COD-FI-ROR-001*Expected Result:*

The facial images meet the following criteria:

- The resolution of the facial images is at least 1244 x 1600 pixels without any up-scaling.
- The aspect ratio of 1244 x 1600 pixels is kept if the image has a higher resolution.
- The resulting facial image is a color image (24 bit sRGB) or a grey scale image (8 bit sRGB).
- The facial images are encoded as JPEG.

Table 2.180 Test Case ID: TC-COD-FI-ROD-001

2.10.9 Test Cases FM COD-FI-VER

Test Case ID: TC-COD-FI-VER-001

Scope Examine requirements for the coding used during the verification process of facial images.

Preconditions

- The IUT is in operation, required modules are loaded.
- The integrated camera system used in the specific application scenario is connected.
- The IUT implements an interface for conformance testing where facial images can be captured.
- The IUT is able to return the results as TR XML for every verification process of facial images.
- As necessary test resources: a biometric test subject whose biometric features are acquired using the IUT.

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-COD-FI-VER-001/1

Table 2.182 TC-COD-FI-VER-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Perform the facial image acquisition process using the IUT. • Initiate a face verification process. <p><i>Expected Result:</i></p> <p>The resulting data of the verification process is encoded in an appropriate XML TR-03121 format and can be successfully validated against the TR-03121 XML schema definition files.</p>

Table 2.181 Test Case ID: TC-COD-FI-VER-001

2.10.10 Test Cases FM COD-FP-GID

Test Case ID: TC-COD-FP-GID-001

Scope Correct coding of the CBEFF container

Test Case ID: TC-COD-FP-GID-001

- Preconditions*
- IUT is running, required modules are loaded
 - A multi fingerprint scanner and facial camera is connected
 - As necessary test resources: a test person to perform the biometric acquisition with
 - IUT is configured to perform the identification process including following steps
 - Manual acquisition of two plain fingerprints using the IUT
 - Provision of any other than biometric data (e.g. biographic, agency or process related) may be done in form of static dummy values by IUT, so that the process can be finalized and the resulting data is returned by IUT as CBEFF container

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-COD-FP-GID-001/1

Table 2.184 TC-COD-FP-GID-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Decoding of the CBEFF Header, Biometric Header Template (BHT) (XML element <data>) for each fingerprint</p> <p><i>Expected Result:</i></p> <p>Provision of the according biometric container including the fingerprint data:</p> <ul style="list-style-type: none"> • CBEFF Patron Header Version = '0101' • BDB Biometric Type: value = '08' (Fingerprint) • BDB Biometric Subtype: one of the following values: <ul style="list-style-type: none"> • 0000 0101 (thumb right) • 0000 0110 (thumb left) • 0000 1001 (index right) • 0000 1010 (index left) • 0000 1101 (middle finger right) • 0000 1110 (middle finger left) • 0001 0001 (ring finger right) • 0001 0010 (ring finger left) • BDB Format Owner: value = '0x0101' (ISO/IEC JTC 1 SC 37-Biometrics) • BDB Format Type: value = '0x0007' (ISO/IEC JTC 1 SC 37-Biometrics)
2	<p><i>Description:</i></p> <p>Decoding of the general record header</p>

Test Case ID: TC-COD-FP-GID-001

Expected Result:

- Format Identifier = 0x46495200 ("FIR" - Finger Image Record)
- Version Number = 0x30313000 ("010")
- Record Length = 32+ 1 * (14 bytes + Data length)
- Capture device ID = 2 bytes (Vendor specified)
- Image acquisition level = '0x001F' (Level 31) or '0x0029' (Level 41)
- Number of fingers = 1
- Scale units = 1 (pixel/inch)
- Scan resolution (horiz) = 01F4 (500ppi)
- Scan resolution (vert) = 01F4 (500ppi)
- Image resolution (horiz) <= Scan resolution (horiz)
- Image resolution (vert) <= Scan resolution (vert)
- Pixel depth = 08 (256 grae levels)
- Image compression Algorithm = 02 (WSQ)
- Reserved = 00 00

3

Description:

Decoding of the finger image header record

Expected Result:

- Length of finger data block (bytes) = includes header and the image data block
- Finger position = finger code {1,2,3,4,6,7,8,9}
- Count of views = '01'
- View number = '01'
- Finger image quality {0-100} or 255 in case of error
- Impression type = 0 (Live-scan plain)
- Horizontal line length >0
- Vertical line length >0
- Reserved = 00

4

Description:

Examination of the finger image data

Expected Result:

- Finger image data size < 18432 bytes
- Encoded as WSQ image
- sf value coded in the image header unequal 0

Table 2.183 Test Case ID: TC-COD-FP-GID-001

2.10.11 Test Cases FM COD-FP-VER

Test Case ID: TC-COD-FP-VER-001

Scope

Examine requirements for the coding used during the verification process of fingerprint images.

Test Case ID: TC-COD-FP-VER-001

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - The integrated camera system used in the specific application scenario is connected.
 - The IUT implements an interface for conformance testing where fingerprint images can be captured.
 - The IUT is able to return the results as TR XML for every verification process of fingerprint images.
 - As necessary test resources: a biometric test subject whose biometric features are acquired using the IUT.

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-COD-FP-VER-001/1

Table 2.186 TC-COD-FP-VER-001 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Perform the fingerprint image acquisition process using the IUT. • Initiate a fingerprint verification process. <p><i>Expected Result:</i></p> <p>The resulting data of the verification process is encoded in an appropriate XML TR-03121 format and can be successfully validated against the TR-03121 XML schema definition files.</p>

Table 2.185 Test Case ID: TC-COD-FP-VER-001

3 Test Cases Partial Application Processes

The following sections define test cases for Partial Application Processes.

3.1 Test Cases PAP ACQ-FI-SV-5: Supervised Facial Image Acquisition System

Test Case ID: TC-PAP-ACQ-FI-SV-5-001

<i>Scope</i>	<p>Examination of the availability and the correctness of veto power of the operator in the automated and manual capturing process for facial image acquisition.</p> <p>The test case is separated in different groups of steps:</p> <ul style="list-style-type: none"> • Steps A.*: Test of manual rejection succeeded by an acceptance during automated facial image acquisition. • Steps B.*: Test of manual rejection succeeded by an acceptance, including switching from manual to automated facial image acquisition. <p>Note that the support of a manual service mode is optional within the application context German Identity Documents (GID). If the IUT does not supports a manual mode, the teststeps B.* are omitted.</p>
<i>Preconditions</i>	<ul style="list-style-type: none"> • If HLBS is used by the system, the HLBS service definition interface for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented. • The integrated camera system used in the specific application scenario is connected.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-5-001/1

Table 3.2 TC-PAP-ACQ-FI-SV-5-001 Test Case Variants

<i>Description</i>	<table border="1"> <thead> <tr> <th>Step</th> <th>Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td>A.1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts an automated acquisition process of a facial image for enrolment or verification/identification. • The operator triggers the capturing process of a facial image. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process autonomously, i.e. the system handles the entire process execution, including configuration of the camera system to the height of the biometric subject. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. </td> </tr> <tr> <td>A.2</td> <td> <p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>The IUT starts a new automated acquisition process of a facial image for enrolment or verification/identification.</p> </td> </tr> <tr> <td>A.3</td> <td> <p><i>Description:</i></p> <p>The operator triggers the capturing process of a facial image.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	A.1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts an automated acquisition process of a facial image for enrolment or verification/identification. • The operator triggers the capturing process of a facial image. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process autonomously, i.e. the system handles the entire process execution, including configuration of the camera system to the height of the biometric subject. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. 	A.2	<p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>The IUT starts a new automated acquisition process of a facial image for enrolment or verification/identification.</p>	A.3	<p><i>Description:</i></p> <p>The operator triggers the capturing process of a facial image.</p>
Step	Description / Expected Result								
A.1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts an automated acquisition process of a facial image for enrolment or verification/identification. • The operator triggers the capturing process of a facial image. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process autonomously, i.e. the system handles the entire process execution, including configuration of the camera system to the height of the biometric subject. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. 								
A.2	<p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>The IUT starts a new automated acquisition process of a facial image for enrolment or verification/identification.</p>								
A.3	<p><i>Description:</i></p> <p>The operator triggers the capturing process of a facial image.</p>								

Test Case ID: TC-PAP-ACQ-FI-SV-5-001

	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process autonomously, i.e. the system handles the entire process execution, including configuration of the camera system to the height of the biometric subject. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.
A.4	<p><i>Description:</i></p> <p>The operator accepts the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned (bio:FaceAcquisition).</p>
B.1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts a manual acquisition process of a facial image for enrolment or verification/identification. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject.
B.2	<p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p>
B.3	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.
B.4	<p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT starts a new manual acquisition process of a facial image for enrolment or verification/identification. • The IUT executes the process where each sub-process requires manual handling of the operator.
B.5	<p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p>
B.6	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p>

Test Case ID: TC-PAP-ACQ-FI-SV-5-001

B.7	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. <p><i>Description:</i></p> <p>The operator accepts the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (bio:FaceAcquisition).</p>
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Table 3.1 Test Case ID: TC-PAP-ACQ-FI-SV-5-001

Test Case ID: TC-PAP-ACQ-FI-SV-5-002

Scope	Examination of the availability and the correctness of the camera adjustment in the manual capturing process for facial image acquisition.
Preconditions	<ul style="list-style-type: none"> • If HLBS is used by the system, the HLBS service definition interface for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented. • The integrated camera system used in the specific application scenario is connected.
CTS Mode	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-5-002/1

Table 3.4 TC-PAP-ACQ-FI-SV-5-002 Test Case Variants

Description	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #333; color: white;"> <th style="text-align: left; padding: 5px;">Step</th> <th style="text-align: left; padding: 5px;">Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top; padding: 5px;">1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts a manual acquisition process of a facial image for enrolment or verification/identification. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject. </td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">2</td> <td> <p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p> </td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">3</td> <td> <p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts a manual acquisition process of a facial image for enrolment or verification/identification. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject. 	2	<p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p>	3	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.
Step	Description / Expected Result								
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts a manual acquisition process of a facial image for enrolment or verification/identification. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject. 								
2	<p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p>								
3	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result. 								

Test Case ID: TC-PAP-ACQ-FI-SV-5-002

4	<p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT starts a new manual acquisition process of a facial image for enrolment or verification/identification. • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject.
5	<p><i>Description:</i></p> <p>The operator manually increases the height configuration of the camera system up to the maximum height configuration.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height configured by the operator.</p>
6	<p><i>Description:</i></p> <p>The operator manually decreases the height configuration of the camera system down to the minimum height configuration.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height configured by the operator.</p>
7	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.
8	<p><i>Description:</i></p> <p>The operator accepts the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (<code>bio:FaceAcquisition</code>).</p>

Table 3.3 Test Case ID: TC-PAP-ACQ-FI-SV-5-002

Test Case ID: TC-PAP-ACQ-FI-SV-5-003

<i>Scope</i>	Examination of the availability and the correctness of the switching functionality between the automated and the manual capturing process for facial image acquisition.
<i>Preconditions</i>	<ul style="list-style-type: none"> • If HLBS is used by the system, the HLBS service definition interface for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented. • The integrated camera system used in the specific application scenario is connected.

Test Case ID: TC-PAP-ACQ-FI-SV-5-003

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-5-003/3

Table 3.6 TC-PAP-ACQ-FI-SV-5-003 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's acquisition area. • The operator starts a manual acquisition process of a facial image for enrolment or verification/identification. • The operator switches from the manual acquisition process to an automated acquisition process. • The operator triggers the capturing process of a facial image. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process autonomously, i.e. the system handles the entire process execution, including configuration of the camera system to the height of the biometric subject. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.
2	<p><i>Description:</i></p> <p>The operator rejects the acquired facial image.</p> <p><i>Expected Result:</i></p> <p>The IUT starts a new automated acquisition process of a facial image for enrolment or verification/identification.</p>
3	<p><i>Description:</i></p> <p>The operator switches from the automated acquisition process to a manual acquisition process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the process where each sub-process requires manual handling of the operator. • The IUT's test interface offers the operator the option to manually adjust the camera system to the height of the biometric subject.
4	<p><i>Description:</i></p> <p>The operator triggers the automatic height configuration process of a facial image for enrolment or verification/identification.</p> <p><i>Expected Result:</i></p> <p>The IUT adjusts the configuration of the camera system to the height of the biometric subject.</p>
5	<p><i>Description:</i></p> <p>The operator triggers the facial image capturing process.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT executes the face image capturing process. • The operator conducts a manual QA of the acquired facial image and reviews the software-based QA result.

Test Case ID: TC-PAP-ACQ-FI-SV-5-003

6

Description:

The operator accepts the acquired facial image.

Expected Result:

As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned via the test interface (`bio:FaceAcquisition`).

Table 3.5 Test Case ID: TC-PAP-ACQ-FI-SV-5-003

3.2 Test Cases PAP ACQ-FI-AUTO-1: Automated Facial Image Acquisition

Test Case ID: TC-PAP-ACQ-FI-AUTO-1-001

Scope Examination of the correctness and duration of the unsupervised automated face image acquisition processes for optimal face presentations (bona fide).

Preconditions

- If HLBS is used by the system, the HLBS service definition for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented.
- The integrated camera system used in the specific application scenario is connected.
- Depending on the scenario the IUT is used in (supervised or non-supervised), PAD functionality is to be activated or disabled for performing the test case. The active setting has to be regarded when the results of this test case are evaluated.

CTS Mode

- interactive
- No provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-PAP-ACQ-FI-AUTO-1-001/1

Table 3.8 TC-PAP-ACQ-FI-AUTO-1-001 Test Case Variants
Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's capture area. • The process for automated facial image acquisition is started. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT guides the biometric subject to present a compliant face presentation according to FM AS-FI-ICS3. • The IUT adjusts the configuration of the camera system to the height of the biometric subject.
2	<p><i>Description:</i></p> <p>The biometric subject enters alone in the optimal distance range.</p> <p><i>Expected Result:</i></p> <p>All acceptance conditions (no multiple faces and optimal distance) are met according to FM AS-FI-ICS3.</p>
3	<p><i>Description:</i></p> <p>The biometric subject performs an optimal (bona fide) face presentation.</p>

Test Case ID: TC-PAP-ACQ-FI-AUTO-1-001

Expected Result:

- The IUT captures a face image.
- Depending on the PAD configuration, the IUT performs a PAD.
- In case the IUT performs a PAD, all acceptance conditions are met according to PAD-FI-APP.
- The IUT assesses the quality of the captured face image.
- All acceptance conditions are met according to QA-FI-GENERIC.
- As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned (`bio:FaceAcquisition`).
- Regarding acquisition time, the following requirements are met (depending on the application context in question):
 - Within the application context Border Control (BCL), the time required for the overall facial image acquisition process did not exceed ten seconds if PAD is performed or seven seconds if no PAD is performed.
 - Within the application context German Identity Documents (GID), the time required for the overall facial image acquisition process did not exceed thirty seconds (including PAD).

Table 3.7 Test Case ID: TC-ACQ-FI-AUTO-1-001

Test Case ID: TC-ACQ-FI-AUTO-1-002

<i>Scope</i>	Examination of the correctness and availability of timeout of the unsupervised automated face image acquisition processes for non-compliant face presentations.
<i>Preconditions</i>	<ul style="list-style-type: none"> • If HLBS is used by the system, the HLBS service definition for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented. • The integrated camera system used in the specific application scenario is connected. • Depending on the scenario the IUT is used in (supervised or non-supervised), PAD functionality is to be activated or disabled for performing the test case. The active setting has to be regarded when the results of this test case are evaluated.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • test case variants:

/TR03122/TC-PAP-ACQ-FI-AUTO-1-002/1

Table 3.10 TC-PAP-ACQ-FI-AUTO-1-002 Test Case Variants

<i>Description</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #333; color: white;">Step</th> <th style="background-color: #333; color: white;">Description / Expected Result</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">1</td> <td> <p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's capture area. • The process for automated facial image acquisition is started. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT guides the biometric subject to present a compliant face presentation according to FM AS-FI-ICS3. • The IUT adjusts the configuration of the camera system to the height of the biometric subject. </td> </tr> <tr> <td style="text-align: center; vertical-align: top;">2</td> <td> <p><i>Description:</i></p> <p>The biometric subject enters alone in the optimal distance range.</p> </td> </tr> </tbody> </table>	Step	Description / Expected Result	1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's capture area. • The process for automated facial image acquisition is started. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT guides the biometric subject to present a compliant face presentation according to FM AS-FI-ICS3. • The IUT adjusts the configuration of the camera system to the height of the biometric subject. 	2	<p><i>Description:</i></p> <p>The biometric subject enters alone in the optimal distance range.</p>
Step	Description / Expected Result						
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • A single biometric subject is present in the IUT's capture area. • The process for automated facial image acquisition is started. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT guides the biometric subject to present a compliant face presentation according to FM AS-FI-ICS3. • The IUT adjusts the configuration of the camera system to the height of the biometric subject. 						
2	<p><i>Description:</i></p> <p>The biometric subject enters alone in the optimal distance range.</p>						

Test Case ID: TC-ACQ-FI-AUTO-1-002

	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • All acceptance conditions (no multiple faces and optimal distance) are met according to FM AS-FI-ICS3. • As a result, a message conforming to TR-03121 XML containing the encoded facial image is returned (<code>bio:FaceAcquisition</code>).
3	<p><i>Description:</i></p> <p>The biometric subject performs a non-conformant face presentation, e.g. the biometric subject does not look in the camera or disappears from the system.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT captures a face image. • Depending on the PAD configuration, the IUT performs a PAD. • In case the IUT performs a PAD, all acceptance conditions are met according to PAD-FI-APP. • The IUT assesses the quality of the captured face image. • The acceptance conditions are met according to QA-FI-GENERIC.
4	<p><i>Description:</i></p> <p>The biometric subject repeats Step 3 for the duration of the configured timeout.</p> <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT repeats the automated face image acquisition process until the timeout exceeds. • After the timeout is exceeded the IUT aborts the face image acquisition process. • After the timeout is exceeded a message conforming to TR-03121 XML containing the encoded facial image exhibiting the best quality of all captured images may be returned (<code>bio:FaceAcquisition</code>).

Table 3.9 Test Case ID: TC-ACQ-FI-AUTO-1-002

3.3 Test Cases PAP ACQ-FI-SV-2: Supervised Facial Image Acquisition with CIR Lookup

Test Case ID: TC-PAP-ACQ-FI-SV-2_001

<i>Scope</i>	Verify correct behaviour of the image acquisition process when a single admissible image is available from Central Identity Register (CIR)
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • As necessary test resource: A locally available facial image of a test person (simulating CIR data)
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • Image provision as BMP or JPEG using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces") • HTTP method: POST • test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-2-001/1/

Table 3.12 TC-PAP-ACQ-FI-SV-2-001 Test Case Variants

Description	Step	Description / Expected Result
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Test Case ID: TC-PAP-ACQ-FI-SV-2_001

1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Check display of loaded image in IUT • Initiate test case by loading the reference facial image using the test interface <p><i>Expected Result:</i></p> <p>The resource image used as input is displayed within the GUI of the IUT, if applicable cropped and aligned</p>
2	<p><i>Description:</i></p> <p>Check quality indication of loaded image</p> <p><i>Expected Result:</i></p> <p>A <code>bio:FaceQuality</code> element is returned by the IUT via the test interface and an indication whether the face image from the CIR is reusable is given by the IUT.</p>
3	<p><i>Description:</i></p> <p>Verify availability option for manual capture</p> <p><i>Expected Result:</i></p> <p>Besides displaying the loaded image, the IUT presents the option to capture a new live image (do not perform).</p>
4	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Check proper take over of image by IUT • Select the displayed image for re-use <p><i>Expected Result:</i></p> <p>The selected image is accepted for the further process within the IUT (either sufficient quality indication or by operator veto).</p>
5	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify encoding of selected image • Proceed in the process until the facial image is encoded in the output format for export to CIR <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The selected image is encoded and returned via the test interface in an appropriate XML format, e.g. as GSAT3 XML embedded within a TR-03121 XML (element <code>bio:XMLRecord[@type="GSAT-xml"]</code>) • The therein contained image data matches the data of the previously selected image (after proper decoding of element <code>it1:FaceImage</code>)

Table 3.11 Test Case ID: TC-PAP-ACQ-FI-SV-2_001

Test Case ID: TC-PAP-ACQ-FI-SV-2_002

<i>Scope</i>	Verify correct behaviour of the image acquisition process in case multiple admissible images are available from CIR
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • As necessary test resource: Multiple locally available facial images of a test person (simulating CIR data)

Test Case ID: TC-PAP-ACQ-FI-SV-2_002

- CTS Mode*
- interactive
 - Images are provided as BMP or JPEG in a single XML file using the test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")
 - HTTP method: POST
 - test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-2-002/1/

Table 3.14 TC-PAP-ACQ-FI-SV-2-002 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Check display of loaded images in IUT • Initiate test case by loading the reference facial images using the test interface <p><i>Expected Result:</i></p> <p>The resource images used as input are displayed within the GUI of the IUT, if applicable cropped and aligned.</p>
2	<p><i>Description:</i></p> <p>Check quality indication of loaded images</p> <p><i>Expected Result:</i></p> <p>The quality assessment result for each displayed image is indicated and a hint regarding re-usability of each image is given by the IUT. Further, the images are displayed in descending order of QA-rating and the best image is indicated and pre-selected.</p>
3	<p><i>Description:</i></p> <p>Verify availability option for manual capture</p> <p><i>Expected Result:</i></p> <p>Besides the display of the available images, the IUT presents the option to capture a new live image (do not perform).</p>
4	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Check proper take over of image by IUT • Select one of the displayed images for re-use <p><i>Expected Result:</i></p> <p>The selected image is accepted for the further process within the IUT (either sufficient quality indication or by operator veto).</p>
5	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify encoding of selected image • Proceed in the process until the facial image is encoded in the output format for export to CIR <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The selected image is encoded and returned via the test interface in an appropriate XML format, e.g. as GSAT3 XML embedded within a TR-03121 XML (element <code>bio:XMLRecord[@type="GSAT-xml"]</code>) • The therein contained image data matches the data of the previously selected image (after proper decoding of element <code>it1:FaceImage</code>)

Table 3.13 Test Case ID: TC-PAP-ACQ-FI-SV-2_002

Test Case ID: TC-PAP-ACQ-FI-SV-2_003

Scope Verify correct behaviour of the image acquisition when no admissible image is available from CIR

Preconditions

- IUT is running, required modules are loaded
- A connected digital camera, accessible by IUT
- If HLBS is used by the system, the HLBS service definition for "Basic Facial Image Acquisition" specified in TR-03121-2.2 is implemented.
- no provision of pre-defined input data; Test case initiation via test interface (TR-03122-1, Chapter 4, "Conformance Test Interfaces")

CTS Mode

- interactive
- no provision of pre-defined input data
- HTTP method: GET
- test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-2-003/1/

Table 3.16 TC-PAP-ACQ-FI-SV-2-003 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify proper behaviour of IUT • Initiate test case by calling the IUT via the test interface • Check for dialogue in order to perform a live capture <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • IUT does not display any images • IUT displays the option to perform a live capture
2	<p><i>Description:</i></p> <p>Check availability of live image acquisition process</p> <p><i>Expected Result:</i></p> <p>When option for live acquisition is selected, the process starts</p>
3	<p><i>Description:</i></p> <p>Check availability of live image acquisition process</p> <ul style="list-style-type: none"> • Perform a facial capture intentionally resulting in subsequent quality assessment to fail • Check for hint and option to re-capture in IUT (ignore both) • Check for availability of option to veto (i.e. override the negative result of the quality assessment) • Put in veto <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • Veto is accepted by IUT • Captured photo is used in further steps of process
4	<p><i>Description:</i></p> <ul style="list-style-type: none"> • Verify encoding of selected image • Proceed in the process until the facial image is encoded in the output format for export to CIR

Test Case ID: TC-PAP-ACQ-FI-SV-2_003

Expected Result:

- The selected image is encoded and returned via the test interface in an appropriate XML format, e.g. as GSAT3 XML embedded within a TR-03121 XML (element `bio:XMLRecord[@type="GSAT-xml"]`)
- The therein contained image data matches the data of the previously captured image (after proper decoding of element `it1:FaceImage`)

Table 3.15 Test Case ID: TC-PAP-ACQ-FI-SV-2_003

3.4 Test Cases PAP ACQ-FI-SV-4: Supervised Facial Image Acquisition

Test Case ID: TC-PAP-ACQ-FI-SV-4-001

<i>Scope</i>	Verify correct behaviour of facial image acquisition process using live enrolment equipment operated by an operator.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • If HLBS is used by the system, the HLBS service definition for "Facial Image Acquisition" specified in TR-03121-2.2 is implemented. • As test resource: a biometric test subject.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FI-SV-4-001/1/

Table 3.18 TC-PAP-ACQ-FI-SV-4-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the automatic capturing of a proper facial image.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Place the biometric test subject properly in front of the digital camera. • Wait for an automatic captured image. • Verify the displayed image and accept it. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT captured a facial image automatically. • The captured image is cropped and derotated. • A quality assessment of the captured image has been performed. • The image is displayed by the IUT. • The image is released to the requesting application after being accepted. • As a result, an image is returned via the test interface in a XML-Log conforming to TR-03121 XML.

Test Case ID: TC-PAP-ACQ-FI-SV-4-001

2

Description:

Check the automatic capturing of an insufficient facial image.

- Initiate test case using the test interface.
- Place the biometric test subject improperly in front of the digital camera. The quality assessment of the captured images has to be negative for every capture. At least two images SHALL be captured.
- Wait for the timeout.
- Accept the displayed image.

Expected Result:

- The IUT captured a facial images automatically.
- A quality assessment of the captured images was negative.
- The IUT chose the best captured image and displays it.
- The image can be cropped and rotated manually.
- The image is released to the requesting application after beeing accepted.
- As a result, an image is returned via the test interface in a XML-Log conforming to TR-03121 XML.

3

Description:

Check the manual capturing of an image. Note, the quality of the captured image is not relevant for this test.

- Initiate test case using the test interface.
- Verify the option to capture an image manually.
- Capture an image manually.
- Verify the option to crop and rotate the captured image.
- Accept the image.

Expected Result:

- The IUT displays an option to take an image manually.
- An image was captured and is displayed by the IUT.
- The displayed image can be cropped and rotated manually.
- The image is released to the requesting application after being accepted.
- As a result, an image is returned via the test interface in a XML-Log conforming to TR-03121 XML.

4

Description:

Check correct timeout handling.

- Initiate test case using the test interface without placing a test subject in front of the camera.
- Wait for the timeout to trigger.

Expected Result:

- No image was captured.
- The acquisition process ended.

Test Case ID: TC-PAP-ACQ-FI-SV-4-001

5

Description:

Check the rejection of a captured image and restart of the capturing process after image rejection.

- Initiate test case using the test interface.
- Wait roughly 70 % of the timeout time.
- Capture an image.
- Reject the captured image.
- Wait roughly 70 % of the timeout time.
- Capture a new image without restarting the capturing process manually.

Expected Result:

- The IUT displays an image.
- An image can be and was manually rejected.
- The image capture process was restarted automatically.
- The timeout was reset and did not end the capturing process.
- A new image could be captured.

Table 3.17 Test Case ID: TC-PAP-ACQ-FI-SV-4-001

3.5 Test Cases PAP ACQ-FPS-SV-1: Supervised Acquisition Single Slap

Test Case ID: TC-PAP-ACQ-FPS-SV-1_001

<i>Scope</i>	Verify the overall supervised acquisition process for single slap images.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • As test resource: a biometric test subject for fingerprint capture. • If HLBS is used by the system, the "Service Definition Fingerprint Acquisition" of Part 2, Volume 2 of TR-03121 is implemented.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FPS-SV-1-001/1

Table 3.20 TC-PAP-ACQ-FPS-SV-1-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<i>Description:</i> Check the Process without a second slap capture. <ul style="list-style-type: none"> • Initiate test case using the test interface. • Select one finger as missing. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. • Choose not to capture the second slap.

Test Case ID: TC-PAP-ACQ-FPS-SV-1_001

Expected Result:

- The instructions were displayed and correct for the captured fingers.
- The process ended without capturing the second slap.
- A message conforming to TR-03121 XML containing the images for the captured fingers is returned via the test interface.

2

Description:

Check the Process with a second slap capture.

- Initiate test case using the test interface.
- Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.
- Choose to capture the second slap.
- Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.

Expected Result:

- The instructions were displayed for both slaps and correct for the captured fingers.
- The process ended after capturing the second slap.
- A message conforming to TR-03121 XML containing the encoded images is returned via the test interface.

Table 3.19 Test Case ID: TC-PAP-ACQ-FPS-SV-1_001

Test Case ID: TC-PAP-ACQ-FPS-SV-1_002

<i>Scope</i>	Verify the correct acquisition process for a single slap.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • As test resource: a biometric test subject for fingerprint capture.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FPS-SV-1-002/1

Table 3.22 TC-PAP-ACQ-FPS-SV-1-002 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the segmentation, quality assessment and PAD of the slap image acquisition.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. • Choose not to capture the second slap.

Test Case ID: TC-PAP-ACQ-FPS-SV-1_002

Expected Result:

- The captured slap image has been segmented into four single fingerprint images.
- The quality assesment is performed for each single fingerprint image individually.
- PAD has been performed and no warning or error is shown.
- Uniqueness check has been performed and no warning or error for duplicated fingerprints is shown.
- A message conforming to TR-03121 XML containing the encoded images with the QA value and PAD result is returned via the test interface.

2

Description:

Check the uniqueness check of the slap image acquisition.

- Initiate test case using the test interface.
- Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.
- Choose to capture the second slap
- Place the same hand again on the finger scan area.

Expected Result:

- The IUT shows a warning or error for duplicated fingerprint images.
- A message conforming to TR-03121 XML containing the warning was returned via the test interface.

3

Description:

Check the slap classifier. (Only for Volume ARE: This test step is skipped if the recommended FM AS-FP-SLP is not implemented.)

- Verfiy the option to toggle the slap classifier between off and evaluation mode.
- Set the slap classifier to evaluation mode.
- Initiate test case using the test interface.
- Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.
- Choose to capture the second slap
- Place the same hand again on the finger scan area.

Expected Result:

- The IUT threw an error.
- A message conforming to TR-03121 XML containing the error was returned via the test interface.

Table 3.21 Test Case ID: TC-PAP-ACQ-FPS-SV-1_002

Test Case ID: TC-PAP-ACQ-FPS-SV-1_003

Scope Verify the correct behaviour of supervised acquisition process for a single finger. This test case covers PAP Task ACQ-FPP-SV-2.

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - Hardware capable of capturing fingerprint images is connected.
 - As test resource: a biometric test subject for fingerprint capture.

Test Case ID: TC-PAP-ACQ-FPS-SV-1_003

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP_ACQ-FPS-SV-1-003/1

Table 3.24 TC-PAP-ACQ-FPS-SV-1_003 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the behaviour of captured images.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Start the acquisition process and switch to the single finger acquisition. • Follow the instructions of the IUT for the single finger placement on the scanner for the biometric test subject. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • PAD has been performed and no warning or error is shown. • Uniqueness check has been performed and no warning or error for duplicated fingerprints is shown. • A message conforming to TR-03121 XML containing the fingerprint and its QA value is returned via the test interface.
2	<p><i>Description:</i></p> <p>Check the uniqueness check.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Select one finger as missing. • Start the acquisition process and switch to the single finger acquisition. • Follow the instructions of the IUT for the single finger placement on the scanner for the biometric test subject. • Place the same finger on the finger scan area. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The IUT shows a warning or error for duplicated fingerprint images. • A message conforming to TR-03121 XML containing the error was returned via the test interface.

Table 3.23 Test Case ID: TC-PAP-ACQ-FPS-SV-1_003**Test Case ID: TC-PAP-ACQ-FPS-SV-1_004**

- Scope* Verify the overall supervised acquisition process for single slap images where the capture is forced manually.
- Preconditions*
- The IUT is in operation, required modules are loaded.
 - Hardware capable of capturing fingerprint images is connected.
 - As test resource: a biometric test subject for fingerprint capture.
 - If HLBS is used by the system, the "Service Definition Fingerprint Acquisition" of Part 2, Volume 2 of TR-03121 is implemented.

Test Case ID: TC-PAP-ACQ-FPS-SV-1_004

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FPS-SV-1-004/1

Table 3.26 TC-PAP-ACQ-FPS-SV-1-004 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the Process without a second slap capture.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject, but place the fingers in such a manner (with bad quality) that the pre-qualification is insufficient. • The operator forces the capture manually. • Choose not to capture the second slap. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The instructions were displayed and correct for the captured fingers. • The process ended without capturing the second slap. • A message conforming to TR-03121 XML containing the images for the captured fingers is returned via the test interface. • In case the quality of the captured slap was too bad and therefore a segmentation was not possible, an error message is shown. In this case a TR-03121 XML is not required.

Table 3.25 Test Case ID: TC-PAP-ACQ-FPS-SV-1_004

Test Case ID: TC-PAP-ACQ-FPS-SV-1_005

Scope Verify the correct behaviour of supervised acquisition process for a single finger where the capture is forced manually. This test case covers PAP Task ACQ-FPP-SV-2.

- Preconditions*
- The IUT is in operation, required modules are loaded.
 - Hardware capable of capturing fingerprint images is connected.
 - As test resource: a biometric test subject for fingerprint capture.

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FPS-SV-1-005/1

Table 3.28 TC-PAP-ACQ-FPS-SV-1_005 Test Case Variants

Description

Step	Description / Expected Result
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Test Case ID: TC-PAP-ACQ-FPS-SV-1_005

1	<p><i>Description:</i></p> <p>Check the behaviour of captured images.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Start the acquisition process and switch to the single finger acquisition. • Follow the instructions of the IUT for the single finger placement on the scanner for the biometric test subject, but place the fingers in such a manner (with bad quality) that the pre-qualification is insufficient. • The operator forces the capture manually. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • PAD has been performed and no warning or error is shown. • Uniqueness check has been performed and no warning or error for duplicated fingerprints is shown. Further, the overall result of the uniqueness check is logged properly. • A message conforming to TR-03121 XML containing the fingerprint and its QA value is returned via the test interface.
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Table 3.27 Test Case ID: TC-PAP-ACQ-FPS-SV-1_005

3.6 Test Cases PAP ACQ-FP442-SV-1: Supervised Acquisition 4-4-2 for Enrolment

Test Case ID: TC-PAP-ACQ-FP442-SV-1_001

<i>Scope</i>	Verify the overall process of supervised acquisition of fingerprint slaps in the order of 4-4-2.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • As test resource: a biometric test subject for fingerprint capture. • If HLBS is used by the system, the "Service Definition Fingerprint Acquisition" of Part 2, Volume 2 of TR-03121 is implemented.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FP442-SV-1-001/1

Table 3.30 TC-PAP-ACQ-FP442-SV-1-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Verify the order of captured fingerprint images.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The instructions are displayed and correct. • The order of captured fingerprint images is right slap, left slap, both thumbs. • A message conforming to TR-03121 XML containing the encoded images within <code>FingerAcquisition</code> is returned via the test interface .

Test Case ID: TC-PAP-ACQ-FP442-SV-1_001

2	<p><i>Description:</i></p> <p>This test case PAP ACQ-FP4141-SV-1 uses PAP Task ACQ-FPS-SV-1 and PAP Task ACQ-FPP-SV-2 which have been defined as part of PAP ACQ-FPS-SV-1.</p> <ul style="list-style-type: none"> ▶ Test Cases PAP ACQ-FPS-SV-1: Supervised Acquisition Single Slap has to be tested separately for conformance. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> ▶ Test Cases PAP ACQ-FPS-SV-1: Supervised Acquisition Single Slap is passed.
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Table 3.29 Test Case ID: TC-PAP-ACQ-FP442-SV-1_001

3.7 Test Cases PAP ACQ-FP4141-SV-1: Supervised Acquisition 4-1-4-1 for Enrolment

Test Case ID: TC-PAP-ACQ-FP4141-SV-1_001

<i>Scope</i>	Verify the overall process of supervised acquisition of fingerprint slaps in the order of 4-1-4-1.
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • As test resource: a biometric test subject for fingerprint capture. • If HLBS is used by the system, the "Service Definition Fingerprint Acquisition" of Part 2, Volume 2 of TR-03121 is implemented.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FP4141-SV-1-001/1

Table 3.32 TC-PAP-ACQ-FP4141-SV-1-001 Test Case Variants

<i>Description</i>	Step	Description / Expected Result
	1	<p><i>Description:</i></p> <p>Verifies the order of captured fingerprint images.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The instructions are displayed and correct. • The order of captured fingerprint images is right slap, right thumb, left slap, left thumb. • A message conforming to TR-03121 XML containing the encoded images within FingerAcquisition is returned via the test interface .
	2	<p><i>Description:</i></p> <p>This test case PAP ACQ-FP4141-SV-1 uses PAP Task ACQ-FPS-SV-1 and PAP Task ACQ-FPP-SV-2 which have been defined as part of PAP ACQ-FPS-SV-1.</p> <ul style="list-style-type: none"> ▶ Test Cases PAP ACQ-FPS-SV-1: Supervised Acquisition Single Slap has to be tested separately for conformance. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> ▶ Test Cases PAP ACQ-FPS-SV-1: Supervised Acquisition Single Slap is passed.

Table 3.31 Test Case ID: TC-PAP-ACQ-FP4141-SV-1_001

3.8 Test Cases PAP ACQ-FP2P-SV-1: Supervised Acquisition of Two Plain Fingers on Multi-Finger Hardware for Enrolment

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_001

<i>Scope</i>	Examination of the correct process for the acquisition of up to two fingerprints using the two finger capture mode with a multi fingerprint scanner
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A multi fingerprint scanner is connected • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As necessary test resources: a test person to perform the fingerprint acquisition with
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FP2P-SV-1-001/1

Table 3.34 TC-PAP-ACQ-FP2P-SV-1-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Perform the acquisition process of the two fingerprints <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The acquisition is triggered by placing the finger(s) on the acquisition hardware in the two finger mode (right index and left index) • The IUT finishes without any error message • As a result, two encoded fingerprints (left and right index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>
2	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a handicap on the right hand</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Mark index finger of the right hand as handicapped • Perform the acquisition process

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_001

Expected Result:

- The IUT allows marking handicapped fingers before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked finger is excluded from the acquisition process
- The IUT changes to single finger mode
- The IUT finishes without any error message
- As a result, two encoded fingerprints (right thumb, left index finger) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

3

Description:

Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a handicap on the left hand

- Initiate test case by calling the IUT via the test interface
- Mark index finger of the left hand as handicapped
- Perform the acquisition process

Expected Result:

- The IUT allows marking handicapped fingers before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked finger is excluded from the acquisition process
- The IUT changes to single finger mode
- The IUT finishes without any error message
- As a result, two encoded fingerprints (right index finger, left thumb) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

4

Description:

Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a missing hand

- Initiate test case by calling the IUT via the test interface
- Mark a whole hand (right or left) as not available/handicapped
- Perform the acquisition process

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_001

Expected Result:

- The IUT allows marking a hand (or all fingers of one hand individually) as not available before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked hand is excluded from the acquisition process
- The IUT changes to single finger mode for the existing hand
- The IUT finishes without any error message
- As a result, two encoded fingerprints (index finger and thumb of left, respectively right hand) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

5

Description:

Check the correct execution of the acquisition process with fingerprints of insufficient quality, regarding capture repetition

- Initiate test case by calling the IUT via the test interface
- Enforce insufficient quality of at least one fingerprint during capture
- Perform the acquisition process

Expected Result:

- The IUT detects the insufficient quality and restarts the acquisition of the current slap
- The acquisition of the slap of insufficient fingerprint quality is repeated twice (i.e. total of three performed attempts)
- The IUT finishes without any error message
- As a result, two encoded fingerprints (both index fingers) returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

6

Description:

Check whether the IUT supports the execution of the mandatory fallback single-finger acquisition process for cases where a slap capture is not practical.

- Initiate test case by calling the IUT via the test interface
- Perform the acquisition process

Expected Result:

- After selecting the two-finger sequence for multi-finger hardware, the IUT offers an option to start acquisition in single finger mode
- As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_001

7	<p><i>Description:</i></p> <p>In case of a plain fingerprint enrolment scenario: Check whether the IUT supports the execution of the mandatory fallback single finger acquisition process for fingers of insufficient quality.</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Ensure insufficient fingerprint quality of at least one fingerprint • Perform the acquisition process <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • After capturing the slap, the IUT offers an option to start acquisition in single finger mode • As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>
8	<p><i>Description:</i></p> <p>In case of a plain fingerprint enrolment scenario: Check whether the mandatory fallback single finger acquisition process actually replaces the corresponding fingerprints from the slap capture.</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Enforce insufficient quality of one fingerprint during capture of slap • Ensure sufficient quality of the same fingerprint during capture in single-finger acquisition • Perform the acquisition process <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code> • The enforced fingerprint of insufficient quality is replaced by the fingerprint of ensured good quality from single-finger acquisition

Table 3.33 Test Case ID: TC-PAP-ACQ-FP2P-SV-1_001

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_002

<i>Scope</i>	Examination of the correct process for the acquisition of up to two fingerprints using the two finger capture mode with a multi fingerprint scanner where the capture is forced manually.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A multi fingerprint scanner is connected • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As necessary test resources: a test person to perform the fingerprint acquisition with

Test Case ID: TC-PAP-ACQ-FP2P-SV-1_002

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FP2P-SV-1-002/1

Table 3.36 TC-PAP-ACQ-FP2P-SV-1-002 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface, but place the fingers in such a manner (with bad quality) that the pre-qualification is insufficient. • The operator then forces the capture of the two fingerprints manually. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The acquisition is triggered by placing the finger(s) on the acquisition hardware in the two finger mode (right index and left index) • The acquisition is triggered not until the operator forced the capture manually. • The IUT finishes without any error message • As a result, two encoded fingerprints (left and right index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>
2	<p><i>Description:</i></p> <p>Check whether the IUT supports the execution of the mandatory fallback single-finger acquisition process for cases where a slap capture is not practical.</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface, but place the fingers in such a manner (with bad quality) that the pre-qualification is insufficient. • The operator then forces the capture of the two fingerprints manually. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • After selecting the two-finger sequence for multi-finger hardware, the IUT offers an option to start acquisition in single finger mode • The acquisition is triggered not until the operator forced the capture manually. • As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>

Table 3.35 Test Case ID: TC-PAP-ACQ-FP2P-SV-1_002

3.9 Test Cases PAP ACQ-FP2P-SV-2: Supervised Acquisition of Two Plain Fingers on Single-Finger Hardware for Enrolment

Test Case ID: TC-PAP-ACQ-FP2P-SV-2_001

<i>Scope</i>	Examination of the correct process for the acquisition of up to two fingerprints using the two finger capture mode with a single fingerprint scanner
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A single fingerprint scanner is connected • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As necessary test resources: a test person to perform the fingerprint acquisition with
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FP2P-SV-2-001/1

Table 3.38 TC-PAP-ACQ-FP2P-SV-2-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Perform the acquisition process of the two fingerprints <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The acquisition is triggered by placing the finger(s) on the acquisition hardware in the two finger mode (right index and left index) • The IUT finishes without any error message • As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>
2	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a handicap on the right slap</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface • Mark index finger of the right slap as handicapped • Perform the acquisition process

Test Case ID: TC-PAP-ACQ-FP2P-SV-2_001

Expected Result:

- The IUT allows marking handicapped fingers before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked finger is excluded from the acquisition process
- The IUT changes to single finger mode
- The IUT finishes without any error message
- As a result, two encoded fingerprints (right thumb, left index finger) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

3

Description:

Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a handicap on the left slap

- Initiate test case by calling the IUT via the test interface
- Mark index finger of the left slap as handicapped
- Perform the acquisition process

Expected Result:

- The IUT allows marking handicapped fingers before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked finger is excluded from the acquisition process
- The IUT changes to single finger mode
- The IUT finishes without any error message
- As a result, two encoded fingerprints (right index finger, left thumb) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

4

Description:

Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a missing hand.

- Initiate test case by calling the IUT via the test interface
- Mark a whole hand (right or left) as not available/handicapped
- Perform the acquisition process

Test Case ID: TC-PAP-ACQ-FP2P-SV-2_001

Expected Result:

- The IUT allows marking a hand (or all fingers of one hand individually) as not available before acquisition
- The acquisition is triggered by placing the finger(s) on the acquisition hardware
- The marked hand is excluded from the acquisition process
- The IUT captures two fingerprints from the existing hand
- The IUT finishes without any error message
- As a result, two encoded fingerprints (index finger and thumb of left, respectively right hand) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

5

Description:

Check the correct execution of the acquisition process with fingerprints of insufficient quality, regarding capture repetition

- Initiate test case by calling the IUT via the test interface
- Enforce insufficient quality of at least one fingerprint during capture
- Perform the acquisition process

Expected Result:

- The IUT detects the insufficient quality and restarts the acquisition of the current slap
- The acquisition of the slap of insufficient fingerprint quality is repeated twice (i.e. total of three performed attempts)
- The IUT finishes without any error message
- As a result, two encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

Table 3.37 Test Case ID: TC-PAP-ACQ-FP2P-SV-2_001

Test Case ID: TC-PAP-ACQ-FP2P-SV-2_002

<i>Scope</i>	Examination of the correct process for the acquisition of up to two fingerprints using the two finger capture mode with a single fingerprint scanner where the capture is forced manually.
<i>Preconditions</i>	<ul style="list-style-type: none"> • IUT is running, required modules are loaded • A single fingerprint scanner is connected • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As necessary test resources: a test person to perform the fingerprint acquisition with

Test Case ID: TC-PAP-ACQ-FP2P-SV-2_002

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FP2P-SV-2-002/1

Table 3.40 TC-PAP-ACQ-FP2P-SV-2-002 Test Case Variants*Description*

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the correct execution of the acquisition process with fingerprints of sufficient quality</p> <ul style="list-style-type: none"> • Initiate test case by calling the IUT via the test interface, but place the fingers in such a manner (with bad quality) that the pre-qualification is insufficient. • The operator then forces the capture of the two fingerprints manually. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The acquisition is triggered by placing the finger(s) on the acquisition hardware in the two finger mode (right index and left index) • The acquisition is triggered not until the operator forced the capture manually. • The IUT finishes without any error message • As a result, two encoded fingerprints (both index fingers) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element <code>bio:FingerAcquisition</code> and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element <code>bio:Records</code>

Table 3.39 Test Case ID: TC-PAP-ACQ-FP2P-SV-2_002

3.10 Test Cases PAP ACQ-FP10R-SV-1: Ten Finger Rolled Supervised Acquisition for Enrolment

Test Case ID: TC-PAP-ACQ-FP10R-SV-1_001

Scope Examination of the correct process for the acquisition of up to ten rolled fingerprints

- Preconditions*
- IUT is running
 - A fingerprint scanner providing rolled fingerprints is connected
 - If HLBS is used by the system, the HLBS service definition for "Rolled Fingerprint Acquisition" specified in TR-03121-2.2 is implemented.
 - As necessary test resources: a test person to perform the fingerprint acquisition with

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FP10R-SV-1-001/1

Table 3.42 TC-PAP-ACQ-FP10R-SV-1-001 Test Case Variants*Description*

Step	Description / Expected Result
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Test Case ID: TC-PAP-ACQ-FP10R-SV-1_001

- 1
- Description:*
- Check the correct execution of the acquisition process with fingerprints of sufficient quality
- Initiate test case by calling the IUT via the test interface
 - Perform the flat acquisition process of all fingers in order to obtain the necessary reference data for the control verification
 - Perform the rolled acquisition process of all fingers, beginning with the thumb of the right hand and ending with the little finger of the left hand
- Expected Result:*
- The acquisition of the reference slaps is performed by the IUT
 - The IUT successively performs the acquisition of the rolled fingerprints
 - The IUT finishes without any error message
 - As a result, ten encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`
- 2
- Description:*
- Check the correct execution of the acquisition process with fingerprints of sufficient quality, with a handicapped finger
- Initiate test case by calling the IUT via the test interface
 - Mark one finger as handicapped in the IUT
 - Perform the acquisition process for the control slaps
 - Perform the acquisition process for the rolled prints
- Expected Result:*
- The IUT allows marking handicapped fingers before acquisition
 - The marked finger is excluded from both acquisition processes
 - The IUT finishes without any error message
 - As a result, nine encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`
- 3
- Description:*
- Check the correct execution of the acquisition process with fingerprints of sufficient quality, with multiple handicapped fingers
- Initiate test case by calling the IUT via the test interface
 - Mark multiple fingers as handicapped in the IUT
 - Perform the acquisition process for the control slaps
 - Perform the acquisition process for the rolled prints

Test Case ID: TC-PAP-ACQ-FP10R-SV-1_001

Expected Result:

- The IUT allows marking multiple handicapped fingers before acquisition.
- The marked fingers are excluded from both acquisition processes.
- The IUT finishes without any error message.
- As a result, encoded fingerprints (depending on missing ones) are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`.

4

Description:

Check the correct execution of the acquisition process with fingerprints of insufficient quality, regarding capture repetition

- Initiate test case by calling the IUT via the test interface
- Enforce insufficient quality of at least one fingerprint during capture
- Perform the acquisition process for the control slaps
- Perform the acquisition process for the rolled prints

Expected Result:

- The IUT detects the insufficient quality and restarts the acquisition of the current finger
- Perform the control slap acquisition regularly, e.g. without inducing errors
- The rolled acquisition of the finger with insufficient fingerprint quality is repeated twice (i.e. total of three performed attempts)
- The IUT finishes without any error message
- As a result, ten encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`

Table 3.41 Test Case ID: TC-PAP-ACQ-FP10R-SV-1_001

Test Case ID: TC-PAP-ACQ-FP10R-SV-1_002

Scope Examination of the correct process for the acquisition of rolled fingerprints in case the IUTs hardware reports issues

- Preconditions*
- IUT is running
 - A fingerprint scanner providing rolled fingerprints is connected
 - If HLBS is used by the system, the HLBS service definition for "Rolled Fingerprint Acquisition" specified in TR-03121-2.2 is implemented.
 - As necessary test resources: a test person to perform the fingerprint acquisition with

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FP10R-SV-1-002/1

Table 3.44 TC-PAP-ACQ-FP10R-SV-1-002 Test Case Variants

Description

Step	Description / Expected Result
------	-------------------------------

Test Case ID: TC-PAP-ACQ-FP10R-SV-1_002

1

Description:

Check the correct execution of the acquisition process with fingerprints of sufficient quality, but with hardware reported issues

- Initiate test case by calling the IUT via the test interface
- Perform the control slap acquisition regularly, e.g. without inducing errors
- Enforce a hardware reported issue during the rolled capture process for at least one finger. Consult the documentation of the hardware in regards of supported issues (e.g. “finger shifted”)
- Repeat the capture without enforcing any further errors and finalize the acquisition process

Expected Result:

- The IUT detects the hardware issue and restarts the acquisition of the current finger.
- The IUT finishes without any error message.
- As a result, ten encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`. The `rejectionReason` element matches the reason chosen by the operator.

2

Description:

Check the correct execution of the acquisition process with fingerprints of insufficient quality and with hardware reported issues

- Initiate test case by calling the IUT via the test interface
- Perform the control slap acquisition regularly, e.g. without inducing errors
- Enforce a hardware reported issue during the rolled capture process for at least one finger. Consult the documentation of the hardware in regards of supported issues (e.g. shift)
- Two times: Enforce insufficient quality of the same fingerprint during the capture
- For the remaining fingers: perform the acquisition process as usual

Expected Result:

- The IUT detects the hardware issue and restarts the rolled acquisition of the current finger
- The IUT detects the insufficient quality and restarts the rolled acquisition of the current finger
- The acquisition was repeated twice in total (one time due to the rolling issue, one time due to the quality)
- The IUT finishes without any error message
- As a result, ten encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`. The repetition with the best QA score is marked as “selected” and the `rejectionReason` for the first attempts matches the reason chosen by the operator.

Test Case ID: TC-PAP-ACQ-FP10R-SV-1_002

3

Description:

Check the ability of operators to accept negative capture results in case both fingerprints of insufficient quality and hardware reported issues are encountered

- Initiate test case by calling the IUT via the test interface
- Perform the control slap acquisition regularly, e.g. without inducing errors
- Enforce a hardware reported issue during the rolled capture process for at least one finger. Consult the documentation of the hardware in regards of supported issues (e.g. shift)
- Enforce insufficient quality of the same fingerprint during capture
- Enforce another hardware reported issue during the final capture attempt for the finger. Afterwards select the option to keep the current results
- For the remaining fingers: perform the acquisition process as usual

Expected Result:

- The IUT detects the hardware issue and restarts the acquisition of the current finger.
- The IUT detects the insufficient quality and restarts the acquisition of the current finger.
- The IUT detects the hardware issue and offers to either restart the capture or to continue with the current result.
- As a result, ten encoded fingerprints are returned via the test interface in a message conforming to TR-03121 XML. The XML must also include the information corresponding to the performed acquisition process (element `bio:FingerAcquisition` and relevant sub-elements). The raw fingerprint data may be stored either as sub-element of this element or as descendant of the sibling element `bio:Records`. The first repetition with insufficient QA score is marked as "selected" and the `rejectionReason` for the first and last attempts matches the reason chosen by the operator.

Table 3.43 Test Case ID: TC-PAP-ACQ-FP10R-SV-1_002

3.11 Test Cases PAP ACQ-FPS-USV-1: Unsupervised Acquisition Single Slap

Test Case ID: TC-PAP-ACQ-FPS-USV-1_001

<i>Scope</i>	Verify the correct acquisition process for a single slap with four fingers and missing finger(s).
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As test resource: a biometric test subject for fingerprint capture.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants:

/TR03122/TC-PAP-ACQ-FPS-USV-1-001/1

Table 3.46 TC-PAP-ACQ-FPS-USV-1-001 Test Case Variants

<i>Description</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #333; color: white; padding: 5px;">Step</th> <th style="background-color: #333; color: white; padding: 5px;">Description / Expected Result</th> </tr> </thead> </table>	Step	Description / Expected Result
Step	Description / Expected Result		

Test Case ID: TC-PAP-ACQ-FPS-USV-1_001

- 1
- Description:*
- Check the capturing of surveillance images, segmentation, quality assessment, PAD, uniqueness check result and time required for the slap image acquisition.
- Initiate test case using the test interface.
 - Present slap with four fingers.
 - Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.
- Expected Result:*
- The captured slap image are segmented into four single fingerprint images.
 - PAD has been performed for each single fingerprint image and no warning or error (such as uniqueness check error) is shown.
 - Surveillance images are captured.
 - The quality assessment is performed for each single fingerprint image individually.
 - The slap classification is performed.
 - The overall finger slap capture process was performed in under ten seconds.
 - A message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the result of the slap classifier, the uniqueness check result and captured surveillance images is returned via the test interface.
- 2
- Description:*
- Check the timeout of the capturing process.
- Initiate test case using the test interface.
 - Increase the minimum required quality thresholds for each fingerprint to 100.
 - Consecutively present slap with four fingers.
 - Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.
- Expected Result:*
- The captured slap image are segmented into four single fingerprint images.
 - PAD has been performed for each single fingerprint image and no warning or error (such as uniqueness check error) is shown.
 - Surveillance images are captured.
 - The quality assessment is performed for each single fingerprint image individually and the overall quality assessment is negative.
 - The slap classification is performed.
 - The capturing process is restarted until the timeout of 10 seconds is reached.
 - After the timeout is reached the captured slap with best quality is identified and a message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the result of the slap classifier, the uniqueness check result and captured surveillance images is returned via the test interface.
- 3
- Description:*
- Check the Process with missing fingers.
- Initiate test case using the test interface.
 - Present slap with at least one finger missing.
 - Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.

Test Case ID: TC-PAP-ACQ-FPS-USV-1_001

4	<p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The captured finger and surveillance images are discarded. • The process ended without capturing the slap. <p><i>Description:</i></p> <p>Check retry option for wrong slap.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Set number of retries larger than zero. • Present wrong slap (i.e. left hand slap instead of right hand slap) with four fingers, follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. • Repeat presenting the wrong slap until process ends. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The number of retries is the same as configured. • For every retry a message is shown, asking the biometric test subject to present the correct slap. (I.e. if the right hand slap is presented, the message asks for the left hand slap.) • A warning is sent to the operator, that the slap classifier detected the presentation of the wrong slap.
5	<p><i>Description:</i></p> <p>Check sequence error function.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Present a slap. • Follow the instructions of the IUT for the placement of the slap on the scanner for the biometric test subject. • Present the same slap a second time, following the instructions of the IUT for the placement of the slap on the scanner for the biometric test subject. • Present the same slap a third time, following the instructions of the IUT for the placement of the slap on the scanner for the biometric test subject. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • After the second presentation of the same slap, a warning message about the detected sequence error (i.e. "This slap has already been captured.") is shown to the biometric subject. • After the third presentation of the same slap, the process ends without capturing a slap.

Table 3.45 Test Case ID: TC-PAP-ACQ-FPS-USV-1_001

3.12 Test Cases PAP ACQ-FP2P-USV-1: Unsupervised Acquisition of Two Plain Fingerprints on Multi-Finger Hardware for Enrolment

Test Case ID: TC-PAP-ACQ-FP2P-USV-1_001

<i>Scope</i>	Verify the correct acquisition process for a single slap with two fingers and missing finger(s).
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As test resource: a biometric test subject for fingerprint capture.

Test Case ID: TC-PAP-ACQ-FP2P-USV-1_001

- CTS Mode*
- interactive
 - no provision of pre-defined input data
 - HTTP method: GET
 - test case variants:

/TR03122/TC-PAP-ACQ-FP2P-USV-1-001/1

Table 3.48 TC-PAP-ACQ-FP2P-USV-1-001 Test Case Variants

Description

Step	Description / Expected Result
1	<p><i>Description:</i></p> <p>Check the segmentation, quality assessment, PAD, uniqueness check result and time required for the slap image acquisition.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Present slap with two fingers. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject. <p><i>Expected Result:</i></p> <ul style="list-style-type: none"> • The captured slap image are segmented into two single fingerprint images. • PAD has been performed for each single fingerprint image and no warning or error (such as uniqueness check error) is shown. • The quality assessment is performed for each single fingerprint image individually. • The slap classification is performed. • The overall finger slap capture process was performed in under ten seconds. • A message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the result of the slap classifier, the uniqueness check result and potentially captured surveillance images is returned via the test interface.
2	<p><i>Description:</i></p> <p>Check the timeout of the capturing process.</p> <ul style="list-style-type: none"> • Initiate test case using the test interface. • Increase the minimum required quality thresholds for each fingerprint to 100. • Consecutively present slap with two fingers. • Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.

Test Case ID: TC-PAP-ACQ-FP2P-USV-1_001

Expected Result:

- The captured slap image are segmented into two single fingerprint images.
- PAD has been performed for each single fingerprint image and no warning or error (such as uniqueness check error) is shown.
- The quality assessment is performed for each single fingerprint image individually and the overall quality assessment is negative.
- The slap classification is performed.
- The capturing process is restarted until the timeout of 10 seconds is reached.
- After the timeout is reached the captured slap with best quality is identified and a message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the result of the slap classifier, the uniqueness check result and potentially captured surveillance images is returned via the test interface.

3

Description:

Check the Process with missing fingers.

- Initiate test case using the test interface.
- Present slap with at least one finger missing.
- Follow the instructions of the IUT for the slap placement on the scanner for the biometric test subject.

Expected Result:

- The captured fingers are discarded.
- The process ended without capturing the slap.

Table 3.47 Test Case ID: TC-PAP-ACQ-FP2P-USV-1_001

3.13 Test Cases PAP ACQ-FP2P-USV-2: Unsupervised Acquisition of Two Plain Fingerprints on Single-Finger Hardware for Enrolment

Test Case ID: TC-PAP-ACQ-FP2P-USV-2_001

<i>Scope</i>	Verify the correct acquisition process for two fingers and missing finger(s).
<i>Preconditions</i>	<ul style="list-style-type: none"> • The IUT is in operation, required modules are loaded. • Hardware capable of capturing fingerprint images is connected. • If HLBS is used by the system, the HLBS service definition for "Fingerprint Acquisition" specified in TR-03121-2.2 is implemented. • As test resource: a biometric test subject for fingerprint capture.
<i>CTS Mode</i>	<ul style="list-style-type: none"> • interactive • no provision of pre-defined input data • HTTP method: GET • test case variants: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> /TR03122/TC-PAP-ACQ-FP2P-USV-2-001/1 </div>

Table 3.50 TC-PAP-ACQ-FP2P-USV-2-001 Test Case Variants

Step	Description / Expected Result
------	-------------------------------

Test Case ID: TC-PAP-ACQ-FP2P-USV-2_001

- 1
- Description:*
- Check the quality assessment, PAD, uniqueness check result and time required for the fingerprint image acquisition.
- Initiate test case using the test interface.
 - Present single fingers subsequently.
 - Follow the instructions of the IUT for the placement of one finger on the scanner for the biometric test subject.
- Expected Result:*
- PAD has been performed for the fingerprint image and no warning or error (such as uniqueness check error) is shown.
 - The quality assessment is performed for the fingerprint image.
 - The overall fingerprint capture process was performed in under ten seconds.
 - A message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the uniqueness check result and potentially captured surveillance images is returned via the test interface.
- 2
- Description:*
- Check the timeout of the capturing process.
- Initiate test case using the test interface.
 - Increase the minimum required quality thresholds for the fingerprint to 100.
 - Consecutively present single fingerprints.
 - Follow the instructions of the IUT for the placement of the single finger on the scanner for the biometric test subject.
- Expected Result:*
- PAD has been performed for the fingerprint image and no warning or error (such as uniqueness check error) is shown.
 - The quality assessment is performed for the fingerprint image and the overall quality assessment is negative.
 - The capturing process is restarted until the timeout of ten seconds is reached.
 - After the timeout is reached the captured fingerprint with best quality is identified and a message conforming to TR-03121 XML containing the encoded images with the QA value, the PAD result, the uniqueness check result and potentially captured surveillance images is returned via the test interface.
- 3
- Description:*
- Check the Process with missing fingers.
- Initiate test case using the test interface.
 - Present no finger.
- Expected Result:*
- The process ended without capturing the fingerprint.

Test Case ID: TC-PAP-ACQ-FP2P-USV-2_001

4

Description:

Check sequence error function.

- Initiate test case using the test interface.
- Present a single finger.
- Follow the instructions of the IUT for the placement of the single finger on the scanner for the biometric test subject.
- Present the same single finger a second time, following the instructions of the IUT for the placement of the single finger on the scanner for the biometric test subject.
- Present the same single finger a third time, following the instructions of the IUT for the placement of the single finger on the scanner for the biometric test subject.

Expected Result:

- After the second presentation of the same finger, a warning message about the detected sequence error (i.e. "This finger has already been captured.") is shown to the biometric subject.
- After the third presentation of the same finger, the process ends without capturing a fingerprint.

Table 3.49 Test Case ID: TC-PAP-ACQ-FP2P-USV-1_001

List of Abbreviations

Abbreviation	Description
BDB	Biometric Data Block
BHT	Biometric Header Template
CBEFF	Common Biometric Exchange Formats Framework
CIR	Central Identity Register
CTF	contrast transfer function
DET	Detection Error Trade-Off
EES	Entry-Exit System
FMR	false-match-rate
FNIR	false-negative-identification-rate
FNMR	false-non-match-rate
FPIR	false-positive-identification-rate
GID	German Identity Document
GSAT3	German Standard for AFIS Transactions Version 3
GUI	graphical user interface
IUT	Implementation Under Test
PAD	Presentation Attack Detection
PAI	Presentation Attack Instrument
QA	Quality Assessment
SIS	Schengen Information System
SNR	signal-to-noise ratio
SSS	self-service system
WSQ	Wavelet Scalar Quantisation

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