

**Facial Image Capturing  
(Middleware)  
Test Procedure**  
VERSION 1.0.0

April Giles  
Nabil Ghadiali



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**FIPS 201 EVALUATION PROGRAM**

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# 1 Overview

Homeland Security Presidential Directive-12 (HSPD-12) - "*Policy for a Common Identification Standard for Federal Employees and Contractors*" directed the promulgation of a new Federal standard for a secure and reliable form of identification issued by all Federal Agencies to their employees and contractors.

In addition to derived test requirements developed to test conformance to the NIST standard, GSA has established interoperability and performance metrics to further determine product suitability. Vendors whose products and services are deemed to be conformant with NIST standards and the GSA interoperability and performance criteria will be eligible to sell their products and services to the Federal Government.

## 1.1 Identification

This document provides the detailed test procedure that needs to be executed by the Lab in order to evaluate the Facial Image Capturing Middleware by testing the INCITS 385 Facial Image profile against the subset of applicable requirements that need to be electronically tested for this category.

## 2 Testing Process

As previously mentioned, this document prescribes detailed test steps that need to be executed in order to test the requirements applicable for this category. Please note that conformance to the tests specified in this document will not result in the Product being compliant to the applicable requirements of FIPS 201. The Product must undergo an evaluation using all the evaluation criteria listed for that category prior to being deemed as compliant. Only products that have successfully completed the entire Approval Process will be designated as conformant to the Standard. To this effect, this document only provides details for the evaluation using the Lab Test Data Report approval mechanism.

A Lab Engineer follows the steps outlined below in order to test those requirements that have been identified to be electronically tested. The end result is a compilation of the observed behavior of the submitted PIV Card in the Lab Test Data Report.

Section 3 provides the test procedures that need to be executed for evaluating the Product or Service as conformant to the requirements of FIPS 201.

### 3 Test Procedure for Electronic Personalization

#### 3.1 Requirements

The following table provides a reference to the requirements that need to be electronically tested within the Lab as outlined in the Approval Procedures document for the Facial Image Capturing Middleware. The test cases that are used to check compliance to the requirements are cross-referenced in the table below.

Identifier #	Requirement Description	Source	Test Case #
FICM.5	The header and the entire data structure shall be CBEFF [compliant].	INCITS 385, Section 5.1	FICM-TP.1
FICM.6	The image data shall be encoded using either JPEG or JPEG2000.	INCITS 385, Section 5.1	FICM-TP.1
FICM.7	The Format Identifier and the Version Number for the standard, are [represented as] null terminated ASCII character strings.	INCITS 385, Section 5.1	FICM-TP.1
FICM.8	All data is represented in binary format [except for the Format identifier and the Version Number].	INCITS 385, Section 5.1	FICM-TP.1
FICM.9	Within the record format and all well-defined data blocks therein, all multi-byte quantities are stored in Big-Endian format.	INCITS 385, Section 5.2.1	FICM-TP.1
FICM.10	All numeric values are fixed-length unsigned integer quantities, unless otherwise specified.	INCITS 385, Section 5.2.2	FICM-TP.1
FICM.11	[The Format Identifier] of the Facial Image Record shall begin with the three ASCII characters 'FAC' to identify the record as following this standard, followed by a zero byte as a null string terminator.	INCITS 385, Section 5.4.1	FICM-TP.1
FICM.12	The Version Number of this specification shall be 0x30313000; "010 - Version 1 revision 0.	INCITS 385, Section 5.4.2	FICM-TP.1
FICM.13	[The Record Length] is the entire length of the record (facial header, facial information, feature points, image information and image data blocks).	INCITS 385, Section 5.4.3	FICM-TP.1
FICM.14	The Number of Facial Images block shall be the number of facial images included in the record.	INCITS 385, Section 5.4.4	FICM-TP.1
FICM.15	The Block Length denotes the sum of the lengths of the Facial Information Block, Facial	INCITS 385, Section 5.5.1	FICM-TP.1

	Feature Block(s), Image Information Block(s), and the Image Data Block(s).		
FICM.16	The Number of Feature Points Block shall be the number of Feature Point blocks that follow the Facial Information Block.	INCITS 385, Section 5.5.2	FICM-TP.1
FICM.17	The Gender Block shall be specified in accordance with Table 3.	INCITS 385, Section 5.5.3	FICM-TP.1
FICM.18	The Eye Color Block shall be specified in accordance with Table 4.	INCITS 385, Section 5.5.4	FICM-TP.1
FICM.19	The Hair Color Block shall be specified in accordance with Table 5.	INCITS 385, Section 5.5.5	FICM-TP.1
FICM.20	The Feature Mask is a bit mask of 3 bytes according to Table 6.	INCITS 385, Section 5.5.6	FICM-TP.1
FICM.21	The Expression block shall be specified in accordance with Table 7.	INCITS 385, Section 5.5.7	FICM-TP.1
FICM.22	The Pose Angles Block shall be used to store the estimate or measure pose of the subject in the image.	INCITS 385, Section 5.5.8	FICM-TP.1
FICM.23	The pose angle yaw is the rotation in degrees about the y-axis (vertical axis) shown in Figure 3.	INCITS 385, Section 5.5.8.1	FICM-TP.1
FICM.24	The pose angle pitch is the rotation in degrees about the x-axis (horizontal axis) shown in Figure 3.	INCITS 385, Section 5.5.8.2	FICM-TP.1
FICM.25	The pose angle roll is the rotation in degrees about the z-axis (the horizontal axis from front to back) shown in Figure 3.	INCITS 385, Section 5.5.8.3	FICM-TP.1
FICM.26	The Pose Angle Uncertainty represents the expected degree of accuracy of the pose angle yaw, pitch, and roll.	INCITS 385, Section 5.5.9	FICM-TP.1
FICM.27	The number of Facial Feature blocks shall be specified in the Number of Facial Features block of the Facial Information structure.	INCITS 385 Section 5.6.1	FICM-TP.1
FICM.28	[The feature type denotes the type of feature point for the Facial Feature block].	INCITS 385, Section 5.6.3	FICM-TP.1
FICM.29	[The Feature Point shall be encoded as $A*16+B$ ].	INCITS 385, Section 5.6.3	FICM-TP.1
FICM.30	[The X coordinate represents the horizontal pixel count from the upper left pixel].	INCITS 385, Section 5.6.3	FICM-TP.1

FICM.31	[The Y coordinate represents the vertical pixel count from the upper left pixel].	INCITS 385, Section 5.6.3	FICM-TP.1
FICM.32	[The Reserved bytes present in the facial feature block is reserved for later use with 3D images].	INCITS 385, Section 5.6.3	FICM-TP.1
FICM.33	The Facial Image type field stores the integer associated with the defined type (format) of the captured face image(s) [and is in accordance with Table 10].	INCITS 385, Section 5.7.1	FICM-TP.1
FICM.34	The Image Data Type block denotes the encoding type of the Image Data block [and is in accordance with Table 11].	INCITS 385, Section 5.7.2	FICM-TP.1
FICM.35	The Width Block shall specify the number of pixels in the horizontal direction.	INCITS 385, Section 5.7.3	FICM-TP.1
FICM.36	The Height Block shall specify the number of pixels in the vertical direction.	INCITS 385, Section 5.7.4	FICM-TP.1
FICM.37	The Image Color Space indicates the color space used in the encoded Image Data block in accordance with the values in Table 12.	INCITS 385, Section 5.7.5	FICM-TP.1
FICM.38	The Source Type block denotes the classification of the source of the captured image and is given in Table 13.	INCITS 385, Section 5.7.6	FICM-TP.1
FICM.39	The Device Type block denotes the vendor specific capture device ID.	INCITS 385, Section 5.7.7	FICM-TP.1
FICM.40	The Quality block shall contain the value 0 indicating Unspecified.	INCITS 385, Section 5.7.8	FICM-TP.1
FICM.41	The Image Data block shall be the raw image data encoded by either the JPEG or JPEG2000 standards.	INCITS 385, Section 5.8.1	FICM-TP.1
FICM.42	One of two possible encodings is to be used for all image types:  1) The JPEG Sequential baseline (ISO/IEC 10918, Part1) mode of operation and encoded in the JFIF file format (the JPEG file format); or  2) The JPEG-2000 Part-1 Code Stream Format (ISO/IEC 15444-1, Part 1) and encoded in the JP2 file format (the JPEG2000 file format).	INCITS 385, Section 6.2	FICM-TP.1
FICM.43	The Format Identifier, Version Number,	INCITS 385,	FICM-TP.1



	Length of Record, and Number of Faces blocks shall be specified.	Section 6.4.1	
FICM.44	The Block Length and Number of Feature Points blocks shall be specified.	INCITS 385, Section 6.4.2	FICM-TP.1
FICM.45	The Face Image Type shall be specified. The Image Data Type, Width, and Height blocks shall be specified.	INCITS 385, Section 6.4.3	FICM-TP.1
FICM.46	The full-face frontal pose shall be used. Rotation of the head shall be less than +/- 5 degrees from frontal in every direction – up/down, rotated left/right, and tilted left/right.	INCITS 385, Section 7.2.2	FICM-TP.1
FICM.47	The expression shall be classified as one of the following: <ul style="list-style-type: none"> <li>a) Neutral (nonsmiling) with both eyes open normally (i.e., not wide-open), and mouth closed.</li> <li>b) A smile where the inside of the mouth and/or teeth is not exposed (closed jaw).</li> <li>c) A smile where the inside of the mouth and/or teeth is exposed.</li> <li>d) Raised eyebrows.</li> <li>e) Eyes looking away from the camera.</li> <li>f) Squinting.</li> <li>g) Frowning.</li> </ul>	INCITS 385, Section 7.2.3	FICM-TP.1
FICM.48	Digital cameras and scanners used to capture facial images shall produce images with a pixel aspect ratio of 1:1. That is, the number of pixels per inch in the vertical dimension shall equal the number of pixels per inch in the horizontal direction.	INCITS 385, Section 7.4.2.1	FICM-TP.1
FICM.49	Frontal images shall be represented as one of the following: <ul style="list-style-type: none"> <li>a) The 24-bit RGB color space where, for every pixel, eight (8) bits will be used to represent each of the Red, Green, and Blue components.</li> <li>b) An 8-bit monochrome color space where, for every pixel, eight (8) bits will be used to represent the luminance component.</li> <li>c) The YUV422 color space where, for every pixel, twice as many bits are dedicated to</li> </ul>	INCITS 385, Section 7.4.3.3	FICM-TP.1

	luminance as the two color channels.		
FICM.50	The Full Frontal face image type is a subclass of the Frontal image type and therefore obeys all normative requirements of clause 6, The Basic Face Image Type, and clause 7, The Frontal Face Image Type. It has a Face Image Type field value of 1 (one).	INCITS 385, Section 8.1	FICM-TP.1
FICM.51	The approximate horizontal midpoints of the mouth and of the bridge of the nose shall lie on an imaginary vertical line AA positioned at the horizontal center of the image.	INCITS 385, Section 8.3.2	FICM-TP.1
FICM.52	An imaginary horizontal line BB through the center of the eyes shall be located between 50% and 70% of the vertical distance up from the bottom edge of the captured image.	INCITS 385, Section 8.3.3	FICM-TP.1
FICM.53	The minimum (Image Width: Head Width) ratio (A:CC) is 7:4.	INCITS 385, Section 8.3.4	FICM-TP.1
FICM.54	The crown to chin portion (DD) of the Full Frontal Image pose shall be no more than 80% of the vertical length of the image (B).	INCITS 385, Section 8.3.5	FICM-TP.1
FICM.55	The Face Image Type shall be specified with value 1.	INCITS 385, Section 8.5.2	FICM-TP.1
FICM.56	The images shall be embedded within the CBEFF structure defined in Section 6.	SP 800-76, Section 5.2	FICM-TP.1
FICM.57	When facial imagery is stored on the PIV Card, only one image shall be stored.	SP 800-76-1, Section 5.2 - Normative Note #3	FICM-TP.1
FICM.58	PIV facial images shall conform to the Full Frontal Image Type defined in Section 8 of [FACESTD].	SP 800-76-1, Section 5.2 - Normative Note #4	FICM-TP.1
FICM.59	Facial image data shall be formatted in either of the compression formats enumerated in Section 6.2 of [FACESTD].	SP 800-76-1, Section 5.2 - Normative Note #5	FICM-TP.1
FICM.60	This specification and Section 8.3.4 of [FACESTD] implies that the image width shall exceed 420 pixels.	SP 800-76-1, Section 5.2 - Normative Note #7	FICM-TP.1
FICM.61	Facial image data shall be converted to the sRGB color space if it is stored.	SP 800-76-1, Section 5.2 - Normative	FICM-TP.1

		Note #8	
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**Table 1 - Applicable Requirements**

### 3.2 Test Components

Table 2 provides the details of all the components required by the Lab to execute this test procedure. Based on the different test cases, different components may be required to execute different cases.

#	Component	Component Details	Identifier
1	Host System	Includes a Workstation with the INCITS 385 PIV Facial Image Tool (PFIT) installed and operational	HOST
2	The INCITS 385 Facial Image Template	The INCITS 385 Facial Image template file submitted by the Supplier	PROD

**Table 2 - Test Procedure: Components**

### 3.3 Test Cases

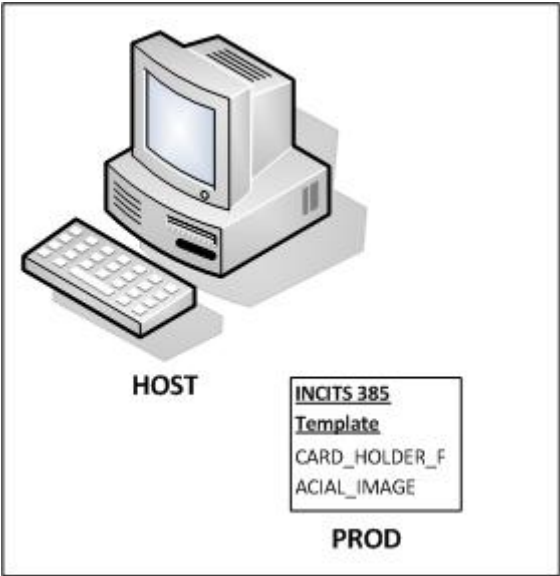
This section discusses the various test cases that are needed to test the INCITS 385 Facial Image template against the requirements mentioned above.

#### 3.3.1 Test Case FICM -TP.1

##### 3.3.1.1 Purpose

The purpose of this test is to verify whether the INCITS 385 Facial Image Template successfully completes the INCITS 385 conformance testing.

##### 3.3.1.2 Test Setup

<p><b>Component:</b></p>	<p>The following components are necessary for executing this test case:</p> <ul style="list-style-type: none"> <li>▪ HOST</li> <li>▪ PROD</li> </ul>
<p><b>Configuration Diagram:</b></p>	<div style="text-align: center;">  <p>The diagram illustrates the test setup. On the left, a computer system consisting of a monitor, a tower unit, and a keyboard is labeled 'HOST'. To the right of the computer is a rectangular box labeled 'PROD'. Inside this box, the text reads: 'INCITS 385 Template' followed by 'CARD HOLDER FACIAL IMAGE' on the next line.</p> </div> <p style="text-align: center;"><b>Figure 1 - Configuration Diagram for Test Case FICM -TP.1</b></p>
<p><b>Preparation:</b></p>	<ul style="list-style-type: none"> <li>▪ Create a folder which specifies the Case Number of the product in testing in the following HOST directory: %PATH TO TESTING DIRECTORY%\<i>case number</i></li> <li>▪ Save PROD in the HOST directory: %PATH TO TESTING DIRECTORY%\<i>case number</i></li> <li>▪ Change<sup>1</sup> the file name of PROD to CARD HOLDER FACIAL IMAGE</li> <li>▪ Verify that the PROD is present in the specified directory of the HOST.</li> <li>▪ Start the PFIT tool             <ol style="list-style-type: none"> <li>1. Click the Configuration Tab</li> </ol> </li> </ul>

<sup>11</sup> The INCITS 385 template submitted may first need to be encapsulated in a CBEFF wrapper prior to renaming. PFIT expects that the file input is enclosed in a CBEFF wrapper.

	<ul style="list-style-type: none"> <li>a. Click Report Settings.                             <ul style="list-style-type: none"> <li>i. In Implementation Under Test, the value should reflect the Case # and Product Name</li> <li>ii. In IUI Date, the value should reflect the current date</li> </ul> </li> <li>b. Click Test Settings                             <ul style="list-style-type: none"> <li>i. If the data under evaluation does not reside on a PIV Card, by default the GET_CONTAINERS_FROM_CARD value shall be 0.</li> <li>ii. The Optional Test Filter should reflect all known optional fields on the PIV Card.</li> <li>iii. The PIN_VALID value should reflect the PIV Application PIN.</li> </ul> </li> <li>c. Expand the Test Settings hive. Click Output Locations.                             <ul style="list-style-type: none"> <li>i. Modify the Configuration Main Path value to append the Case number of the product under evaluation to the %PATH TO TESTING DIRECTORY%\<i>case number</i> directory.</li> </ul> </li> </ul>
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3.3.1.3 Test Process

<b>Test Steps:</b>	<ol style="list-style-type: none"> <li>1. Click the Test Manager tab.</li> <li>2. Execute the required tests by first clicking on the group of tests to perform, and then clicking the Run Selected button.</li> <li>3. Verify that the test has completed by viewing the result on the screen.</li> <li>4. Retain a PDF copy of the report for PROD.</li> </ol>
<b>Expected Result(s):</b>	The test completes successfully with all results showing a “PASS” indicating that the objects on the Template are conformant to the INCITS 385 data model.