FIPS 201 Evaluation Program - Facial Image Capturing (Middleware) Approval Procedure

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GSA

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Table of Contents

List of Tables

1   Introduction

1.1   *Overview*

The FIPS 201 Evaluation Program (EP) is a U.S. Government entity administered by the Office of Government-wide Policy (OGP), within the General Services Administration (GSA) agency. The goal of the FIPS 201 Evaluation Program (EP) is to evaluate products and services against the requirements outlined in FIPS 201 and its supporting documents. In addition to derived test requirements developed to test conformance to the National Institute of Standards and Technology (NIST) Standard, GSA has also established interoperability and performance metrics to further determine product suitability. A set of approval and test procedures have been developed which outline the evaluation criteria, approval mechanisms and test process employed by the Laboratory during their evaluation of a Supplier's product or service against the requirements for that category.

A Supplier desiring to submit a Facial Imaging Capturing (Middleware) (hereafter referred to as the Product) for evaluation must follow the Suppliers Policies and Procedures Handbook. In addition to this handbook, Supplier also need to refer to this Approval Procedure which provides the necessary category-specific details in order to have a Supplier's Product evaluated by the EP and placed on the Approved Products List (APL).

1.2   *Category Description*

The *Facial Image Capturing (Middleware)* is a software component that provides the capability to accept facial images captured by the Facial Image Capturing Camera and to format those images for storage in accordance with SP 800-76-1.

1.3   *Purpose*

The purpose of this document is to provide the following information:

(i)   Provide a list of the artifacts and/or documentation that needs to be submitted to the Evaluation Lab as part of the application package submission.
(ii)   Document the list of the requirements that apply to this category
(iii)   Specify the evaluation criteria along with their approval mechanisms that will be used by Evaluation Labs to verify compliance of the Product against the requirements that apply to this category.

2 Application Package Contents

The Application Package Contents include the artifacts, documentation and in some cases the product itself that needs to be submitted to the Evaluation Lab so that evaluation can be performed. The Application Package Contents for this category include the following:

- Completed Application Form, provided on the Evaluation Program website. (This form will be available through the web interface once users have been assigned a login credential);

- Completed and signed Attestation Form (found in the application submission package ZIP file). The Attestation Form should be completed and scanned into a document to be uploaded to Evaluation Program website;

- Completed and signed Lab Service Agreement (found in the application submission package ZIP file). The Lab Service Agreement should be completed and scanned into a document to be uploaded to Evaluation Program website;

- Completed Supplier VDR-VTDR justification worksheet (found in the application submission package ZIP file);

- A Vendor Test Data Report, which provides test results showing that the Product complies with the requirements for this category. In this regard, the Supplier is expected to develop and document the test procedures used to determine how the Product was tested to arrive at the conclusion that it met all necessary requirements. The VTDR must at a typically contain information as stated in Section 3.2. Wherever possible, information to be supplied as part of this Vendor Test Data Report has been described in Section 3.3;

- All necessary Supplier documentation providing proof that the Product complies with the subset of requirements (as outlined in Section 3.1) for this category which has Supplier documentation review as its approval mechanism. Examples of specific documentation would include: user guides, technical specifications, white papers, line cards, etc.

- At least one sample of the INCITS 385 profile generated by the Product as a result of acquiring a facial image, in binary form. Also, if different types of INCITS 385 profiles are able to be generated (i.e. a profile for encoding to a PIV Card, profiles for Agency retention, multiple images per profile), then the different profiles generated as a result of configuration changes must be submitted as well.

3   Evaluation Procedure for Facial Image Capturing (Middleware)

3.1   Requirements

In order to approve the Product as conformant to the requirements of PIV, it at a minimum, must comply with all the requirements listed below. The approval mechanism column describes the technique utilized by the Lab to evaluate compliance to that particular requirement.

Identifier #	Requirement Description	Source	Reqt. #	Approval Mechanism
FICM.1	Facial images need to conform to the application profile of INCITS 385-2004 tailored for PIV as outlined in Table 6 – *INCITS 385 Profile for PIV Facial Images*".	SP 800-76-1, Section 5.2	2.1-48	Vendor Test Data Report
FICM.2	More than one image may be stored in the record. It may be appropriate to store several images if appearances change over time (e.g. beard, no beard, beard) and images are gathered at issuance. If more than one image is stored in the record, the most recent image shall appear first and serve as the default provided to applications.	SP 800-76-1, Section 5.2	2.1-53	Vendor Test Data Report
FICM.3	Facial images shall be compressed using a compression ratio no higher than 15:1. If ROI compression is used, the innermost region is centered around the face and compressed at no more than 24:1	SP 800-76-1, Section 5.2	2.1-59	Vendor Test Data Report
FICM.4	For PIV, faces shall be acquired such that a 20 centimeter target placed on, and normal to, a camera's optical axis at a range of 1.5 meters shall be imaged with at least 240 pixels across it. This ensures that the width of the head (i.e. dimension CC in Figure 8 of [FACESTD]) shall have sufficient resolution for the printed face element of the PIV Card. 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	2.1-61	Vendor Test Data Report

FICM.5	The header and the entire data structure shall be CBEFF [compliant].	INCITS 385, Section 5.1	8-1	Lab Test Data Report
FICM.6	The image data shall be encoded using either JPEG or JPEG2000.	INCITS 385, Section 5.1	8-2	Vendor Documentation Review Lab Test Data Report
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	8-3	Lab Test Data Report
FICM.8	All data is represented in binary format [except for the Format identifier and the Version Number].	INCITS 385, Section 5.1	8-4	Lab Test Data Report
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	8-5	Lab Test Data Report
FICM.10	All numeric values are fixed-length unsigned integer quantities, unless otherwise specified.	INCITS 385, Section 5.2.2	8-6	Lab Test Data Report
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	8-7	Lab Test Data Report
FICM.12	The Version Number of this specification shall be 0x30313000; "010 - Version 1 revision 0.	INCITS 385, Section 5.4.2	8-8	Lab Test Data Report
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	8-9	Lab Test Data Report
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	8-10	Lab Test Data Report
FICM.15	The Block Length denotes the sum of the lengths of the Facial	INCITS 385, Section 5.5.1	8-11	Lab Test Data Report

	Information Block, Facial 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	8-12	Lab Test Data Report
FICM.17	The Gender Block shall be specified in accordance with Table 3.	INCITS 385, Section 5.5.3	8-13	Lab Test Data Report
FICM.18	The Eye Color Block shall be specified in accordance with Table 4.	INCITS 385, Section 5.5.4	8-14	Lab Test Data Report
FICM.19	The Hair Color Block shall be specified in accordance with Table 5.	INCITS 385, Section 5.5.5	8-15	Lab Test Data Report
FICM.20	The Feature Mask is a bit mask of 3 bytes according to Table 6.	INCITS 385, Section 5.5.6	8-16	Lab Test Data Report
FICM.21	The Expression block shall be specified in accordance with Table 7.	INCITS 385, Section 5.5.7	8-17	Lab Test Data Report
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	8-18	Lab Test Data Report
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	8-19	Lab Test Data Report
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	8-20	Lab Test Data Report
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	8-21	Lab Test Data Report
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	8-22	Lab Test Data Report
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	8-23	Lab Test Data Report
FICM.28	[The feature type denotes the type of	INCITS 385,	8-24	Lab Test Data

	feature point for the Facial Feature block].	Section 5.6.3		Report
FICM.29	[The Feature Point shall be encoded as A*16+B].	INCITS 385, Section 5.6.3	8-25	Lab Test Data Report
FICM.30	[The X coordinate represents the horizontal pixel count from the upper left pixel].	INCITS 385, Section 5.6.3	8-26	Lab Test Data Report
FICM.31	[The Y coordinate represents the vertical pixel count from the upper left pixel].	INCITS 385, Section 5.6.3	8-27	Lab Test Data Report
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	8-28	Lab Test Data Report
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	8-29	Lab Test Data Report
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	8-30	Lab Test Data Report
FICM.35	The Width Block shall specify the number of pixels in the horizontal direction.	INCITS 385, Section 5.7.3	8-31	Lab Test Data Report
FICM.36	The Height Block shall specify the number of pixels in the vertical direction.	INCITS 385, Section 5.7.4	8-32	Lab Test Data Report
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	8-33	Lab Test Data Report
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	8-34	Lab Test Data Report
FICM.39	The Device Type block denotes the vendor specific capture device ID.	INCITS 385, Section 5.7.7	8-35	Lab Test Data Report
FICM.40	The Quality block shall contain the value 0 indicating Unspecified.	INCITS 385, Section 5.7.8	8-36	Lab Test Data Report

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	8-37	Lab Test Data Report
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	8-38	Lab Test Data Report
FICM.43	The Format Identifier, Version Number, Length of Record, and Number of Faces blocks shall be specified.	INCITS 385, Section 6.4.1	8-39	Lab Test Data Report
FICM.44	The Block Length and Number of Feature Points blocks shall be specified.	INCITS 385, Section 6.4.2	8-40	Lab Test Data Report
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	8-41	Lab Test Data Report
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	8-42	Lab Test Data Report
FICM.47	The expression shall be classified as one of the following: a) Neutral (nonsmiling) with both eyes open normally (i.e., not wide-open), and mouth closed. b) A smile where the inside of the mouth and/or teeth is not exposed (closed jaw). c) A smile where the inside of the mouth and/or teeth is exposed.	INCITS 385, Section 7.2.3	8-43	Lab Test Data Report

	d) Raised eyebrows. e) Eyes looking away from the camera. f) Squinting. g) Frowning.			
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	8-44	Lab Test Data Report
FICM.49	Frontal images shall be represented as one of the following: 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. b) An 8-bit monochrome color space where, for every pixel, eight (8) bits will be used to represent the luminance component. c) The YUV422 color space where, for every pixel, twice as many bits are dedicated to luminance as the two color channels.	INCITS 385, Section 7.4.3.3	8-45	Lab Test Data Report
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	8-46	Lab Test Data Report
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	8-47	Lab Test Data Report
FICM.52	An imaginary horizontal line BB through the center of the eyes shall	INCITS 385, Section 8.3.3	8-48	Lab Test Data Report

	be located between 50% and 70% of the vertical distance up from the bottom edge of the captured image.			
	The minimum (Image Width: Head Width) ratio (A:CC) is 7:4.	INCITS 385, Section 8.3.4	8-49	Lab Test Data Report
FICM.53	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	8-50	Lab Test Data Report
FICM.54	The Face Image Type shall be specified with value 1.	INCITS 385, Section 8.5.2	8-51	Lab Test Data Report
FICM.55	The images shall be embedded within the CBEFF structure defined in Section 6.	SP 800-76, Section 5.2	2-2	Lab Test Data Report
FICM.56	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	2.1-54	Lab Test Data Report
FICM.57	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	2.1-55	Lab Test Data Report
FICM.58	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	2.1-56	Lab Test Data Report
FICM.59	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	2.1-61	Lab Test Data Report
FICM.60	Facial image data shall be converted to the sRGB color space if it is stored.	SP 800-76-1, Section 5.2 - Normative Note #8	2.1-64	Lab Test Data Report

Table 1 - Applicable Requirements

3.2 Approval Mechanism Matrix

The table below provides an indication of the total number of requirements applicable for the Product and provides a breakup of how the evaluation will be conducted based on the different approval mechanisms available to the Lab.

Total Requirements	Approval Mechanisms					
	SV	**VTDR**	**LTDR**	**VDR**	**C**	**A**
60	N/A	3	57	1	N/A	1
Legend: SV – Site Visit; VTDR – Vendor Test Data Report; LTDR – Lab Test Data Report; VDR – Vendor Doc. Review; C – Certification; A - Attestation						

Table 2 - Approval Mechanism Matrix

3.3 Evaluation Criteria

This section provides details on the process employed by the Lab for evaluating the Product against the requirements enumerated above.

3.3.1 Vendor Test Data Report

The Lab will update the status in the Web-Enabled Tool to "VTDR Begun" as instructed in the Web-enabled Tool Laboratory User Guide.

3.3.1.1 FICM.1

Evaluation Procedure:	The Lab will review the documentation submitted by the Supplier to ascertain the following: • *Image Data Format*: Conformance of the fields present in the profile compared to the fields defined in Table 6 - "*INCITS 385 Profile for PIV Facial Images*". The following test will be performed to confirm compliance: a. Using the profile(s) created by the Product, parse each field, as defined by INCITS 385 and identify the name of the field and the value.
Expected Result:	The profile indicates the conformance to Table 6 - "*INCITS 385 Profile for PIV Facial Images*".

3.3.1.2 FICM.2

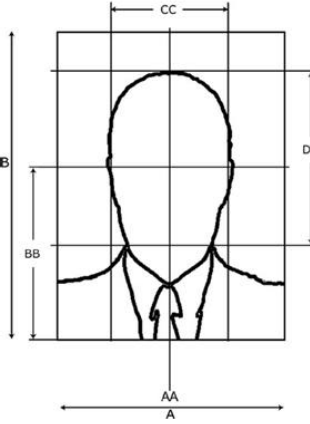| **Evaluation Procedure:**	The Lab will review the documentation submitted by the Supplier to ascertain the following: • *Number of Images Stored*: If more than one image is stored in the record, the most recent image shall appear first and serve as the default provided to applications.

	At a minimum, the following test scenario must be performed to confirm compliance, in the event that the Product is capable of storing multiple images with an INCITS 385 profile:
	a. The Lab Technician will review the binary version of the sample INCITS 385 profile to determine the inclusion of two facial images.
	b. The Supplier shows the ability of the Product to select raw facial images (e.g. via screenshots of the software) and determine their positions within the profile being created. If the Product supports a mechanism to automatically select the most recent image, this shall also be demonstrated. The Supplier may also use other means to show compliance with this requirement if the Product doesn't support a user interface to select the placement location of multiple facial images with a profile.
Expected Result:	The test report clearly shows that when more than one image is stored in the record, the most recent image appears first and serves as the default provided to applications.

3.3.1.3 **FICM.4**

Evaluation Procedure:	The Lab will review the documentation submitted by the Supplier to ascertain the following:
	• *Image Compression*: Facial images are compressed no more than 15: 1. If ROI compression is used then the innermost region is centered around the face and compressed at no more than 24:1.
	At a minimum, the following test scenario must be performed to confirm compliance:
	For whole image compression a. Note down the size of the raw image obtained. b. Compress the image using appropriate compression format and encoding c. Note down the size of the compressed image.
	For ROI compression a. Using the raw image, extract the ROI. b. Note down the size of the ROI to be compressed c. Compress the image using appropriate compression format and encoding d. Note down the size of the final ROI
Expected Result:	The test report indicates that an appropriate level of compression has been applied to the image for regular or ROI compression.

3.3.1.4 **FICM.5**

Evaluation	The Lab will review the documentation submitted by the Supplier to ascertain

11

Procedure:	the following:
	• *Full Frontal Image Type:* The electronic image submitted conforms to the diagram listed below. At a minimum, the following test scenario must be performed to confirm compliance: a. Measure the image width. This value is A. The width of A should exceed 420 pixels. Measure the width of the head. This value is CC. The width of CC should exceed 240 pixels. Find the ratio of the two widths: (Image Width : Head Width). This ratio must be 7:4 (A:CC). The electronic version of this measurement may be submitted to expedite the Lab's evaluation of this requirement.
Expected Result:	The full frontal image type meets the minimum spatial resolution and specified ratio of image width to head width of 7:4.

The Lab will update the status in the Web-Enabled Tool to "VTDR Complete" as instructed in the Web-enabled Tool Laboratory User Guide.

3.3.2 Vendor Documentation Review

Reference(s):	FICM.7

Evaluation Procedure:	1. The Lab will update the status in the Web-Enabled Tool to "VDR Begun" as instructed in the Web-enabled Tool Laboratory User Guide.
	 2. The Lab will review the Product's documentation to determine the following. At a minimum the documents submitted by the Supplier must include:
	 ▪ *Encoding and Compression Format (FICM.7)*
	   • Indication of the encoding format used by the Product
	     a. JPEG
	     b. JPEG-2000
	   • Indication the compression format is utilized by the Product.
	     a. whole-image
	     b. single-region-of-interest (ROI)
	 3. The Lab will update the status to "VDR Complete" as instructed in the

	Web-enabled Tool Laboratory User Guide.
Expected Results	Product documentation submitted by the supplier substantiates that the stored images are encoded and compressed in accordance to specification.

3.3.3 Lab Test Data Report

Reference(s):	FICM.6 to FICM.61
Test Procedure:	1. The Lab will update the status in the Web-Enabled Tool to "LTDR Begun" as instructed in the Web-enabled Tool Laboratory User Guide. 2. The Lab will execute test procedures for this category in accordance with the "*Facial Image Capturing (Middleware) Test Procedure*." 3. The Lab will update the status to "LTDR Complete" as instructed in the Web-enabled Tool Laboratory User Guide.
Expected Result:	1. The Product successfully passes all the test cases documented within the test procedure.

3.3.4 Attestation

Reference(s):	N/A
Evaluation Procedure:	1. The Lab will update the status in the Web-Enabled Tool to "A Begun" as instructed in the Web-enabled Tool Laboratory User Guide. 2. Review the Attestation Form provided by the Supplier, confirming that the Product to the best of their knowledge, conforms to all the necessary requirements of the category under which the Product applies. Verify that person signing this Attestation Form has the authority to do so (a minimum "C" level [e.g. CSO, CEO, CIO, CFO, Vice-President, President, Business Partner or Owner]). 3. The Lab will update the status in the Web-Enabled Tool to "A Complete" as instructed in the Web-enabled Tool Laboratory User Guide.
Expected Results:	The Attestation Form has been signed by an authorized individual (e.g. CSO, CEO, CIO, CFO, Vice-President, President, Business Partner or Owner).