Technical white paper

HP FutureSmart – FADGI Mode

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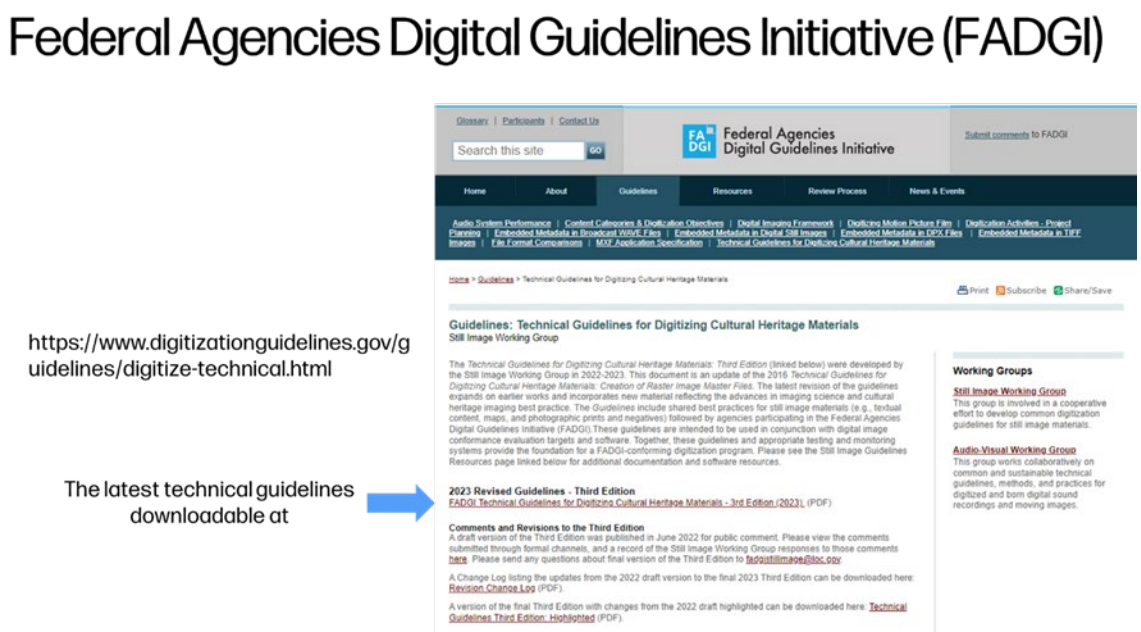
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Overview

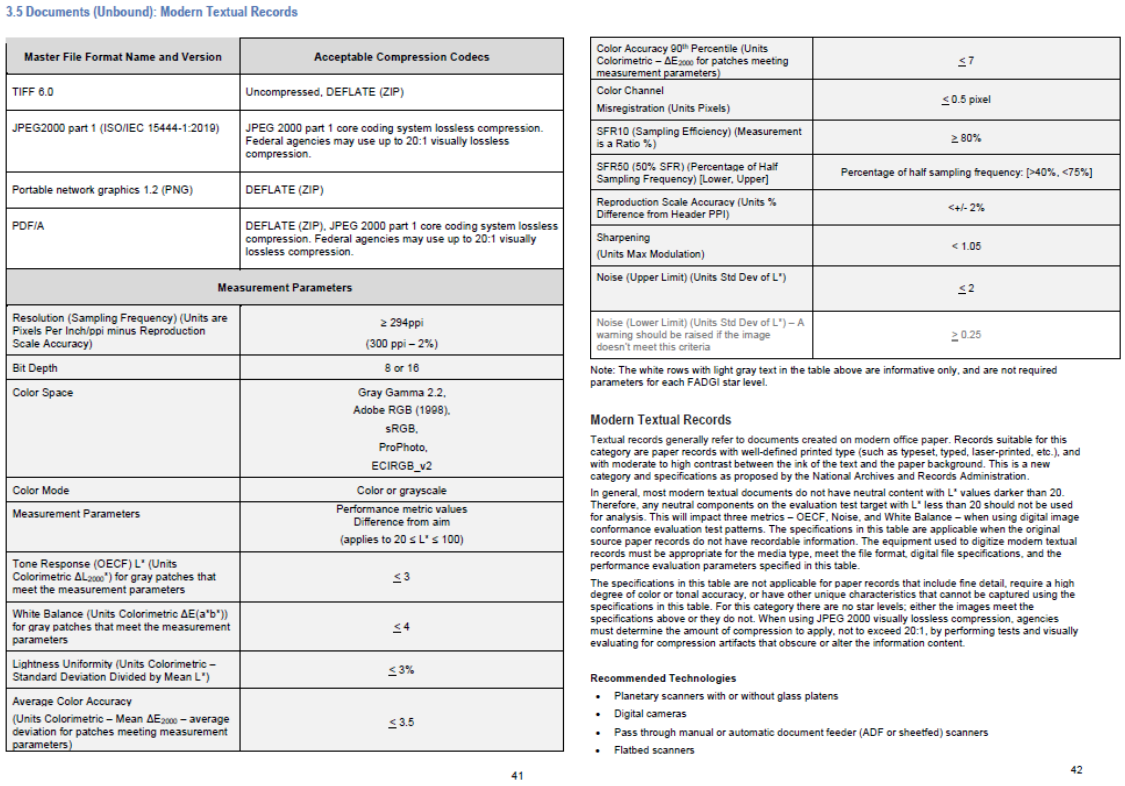
HP Inc. is proud to offer a new scanning mode, FADGI Mode, on selected HP Multi-function printers (MFPs) and HP network scanning devices in compliance with the US Federal Agencies Digital Guideline Initiative (FADGI). The objective of FADGI is stated in the published Technical Guidelines for Digitizing Cultural Heritage Materials, Third Edition, May 2023. The quoted paragraph below shows the primary mission of FADGI:

"The Federal Agency Digital Guideline Initiative (FADGI) Code of Ethics is a set of professional practices to guide imaging practitioners to create faithful reproductions of historic records held in the public trust. By conforming to the guidelines described by the FADGI program we believe values such as accuracy, integrity, and fidelity to the historic record are maintained. The cultural heritage community has a responsibility to produce digital images that look like the original records (textual, photograph, map, plan, etc.) and are a "reasonable reproduction" without enhancement. We encourage the use of digital technology to increase access to information without altering the fundamental nature of the historic record. We advocate for the dissemination of best practices to educate digital imaging practitioners. We recommend the inclusion of metadata or other documentation of the imaging process, and any special processing performed on master digital objects."

The detail descriptions of FADGI and related material can be found and downloaded from **https://www.digitizationguidelines.gov/guidelines/digitize-technical.html** as shown below.



HP's MFP and network scanning devices are engineered with the FADGI scanning mode to meet the accuracy compliance of **Section 3.5: Documents (Unbound): Modern Textual Records** in the Technical Guidelines. Please refer to the description in **Section 3.5: Documents (Unbound): Modern Textual Records** for the accuracy specifications, as shown in the screenshot below.



3.5 Documents (Unbound): Modern Textual Records

Master File Format Name and Version	Acceptable Compression Codecs
TIFF 6.0	Uncompressed, DEFLATE (ZIP)
JPEG2000 part 1 (ISO/IEC 15444-1:2019)	JPEG 2000 part 1 core coding system lossless compression. Federal agencies may use up to 20:1 visually lossless compression.
Portable network graphics 1.2 (PNG)	DEFLATE (ZIP)
PDF/A	DEFLATE (ZIP), JPEG 2000 part 1 core coding system lossless compression. Federal agencies may use up to 20:1 visually lossless compression.
Measurement Parameters	
Resolution (Sampling Frequency) (Units are Pixels Per Inch/ppi minus Reproduction Scale Accuracy)	≥ 294ppi (300 ppi – 2%)
Bit Depth	8 or 16
Color Space	Gray Gamma 2.2, Adobe RGB (1998), sRGB, ProPhoto, ECIRGB_v2
Color Mode	Color or grayscale
Measurement Parameters	Performance metric values Difference from aim (applies to 20 ≤ L* ≤ 100)
Tone Response (OECF) L* (Units Colorimetric ΔL_{2000}*) for gray patches that meet the measurement parameters	≤ 3
White Balance (Units Colorimetric ΔE(a*b*)) for gray patches that meet the measurement parameters	≤ 4
Lightness Uniformity (Units Colorimetric – Standard Deviation Divided by Mean L*)	≤ 3%
Average Color Accuracy (Units Colorimetric – Mean ΔE_{2000} – average deviation for patches meeting measurement parameters)	≤ 3.5

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Color Accuracy 90th Percentile (Units Colorimetric – ΔE_{2000} for patches meeting measurement parameters)	≤ 7
Color Channel Misregistration (Units Pixels)	≤ 0.5 pixel
SFR10 (Sampling Efficiency) (Measurement is a Ratio %)	≥ 80%
SFR50 (50% SFR) (Percentage of Half Sampling Frequency) [Lower, Upper]	Percentage of half sampling frequency: [>40%, <75%]
Reproduction Scale Accuracy (Units % Difference from Header PPI)	<+/- 2%
Sharpening (Units Max Modulation)	< 1.05
Noise (Upper Limit) (Units Std Dev of L*)	≤ 2
Noise (Lower Limit) (Units Std Dev of L*) – A warning should be raised if the image doesn't meet this criteria	≥ 0.25

Note: The white rows with light gray text in the table above are informative only, and are not required parameters for each FADGI star level.

Modern Textual Records

Textual records generally refer to documents created on modern office paper. Records suitable for this category are paper records with well-defined printed type (such as typeset, typed, laser-printed, etc.), and with moderate to high contrast between the ink of the text and the paper background. This is a new category and specifications as proposed by the National Archives and Records Administration.

In general, most modern textual documents do not have neutral content with L* values darker than 20. Therefore, any neutral components on the evaluation test target with L* less than 20 should not be used for analysis. This will impact three metrics – OECF, Noise, and White Balance – when using digital image conformance evaluation test patterns. The specifications in this table are applicable when the original source paper records do not have recordable information. The equipment used to digitize modern textual records must be appropriate for the media type, meet the file format, digital file specifications, and the performance evaluation parameters specified in this table.

The specifications in this table are not applicable for paper records that include fine detail, require a high degree of color or tonal accuracy, or have other unique characteristics that cannot be captured using the specifications in this table. For this category there are no star levels; either the images meet the specifications above or they do not. When using JPEG 2000 visually lossless compression, agencies must determine the amount of compression to apply, not to exceed 20:1, by performing tests and visually evaluating for compression artifacts that obscure or alter the information content.

Recommended Technologies

- Planetary scanners with or without glass platens
- Digital cameras
- Pass through manual or automatic document feeder (ADF or sheetfed) scanners
- Flatbed scanners

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System requirements

FADGI Mode License:

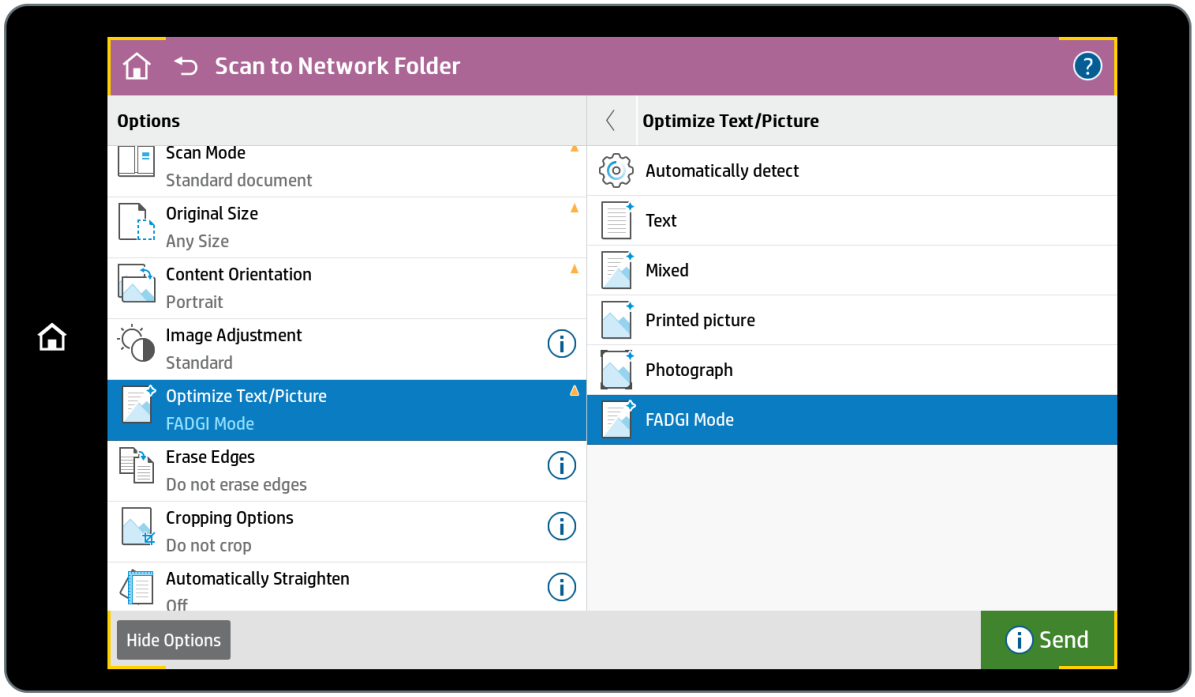
- FADGI mode is a licensing feature and can be enabled by Feature License Delivery (FLD).

Device Firmware Version:

- FutureSmart 5.9 or higher is required to install FADGI mode license.

About FADGI Mode

The FADGI scanning mode is functional on HP Workflow devices with purchased licenses. The mode can be found on the device's control panel within all scanning application icons such as Scan to Email, Scan to Network Folder, Scan to USB, etc. Please refer to HP FutureSmart - Set up and Use FADGI Mode for details. The screenshot below shows a general appearance of FADGI Mode on the control panel of HP devices.

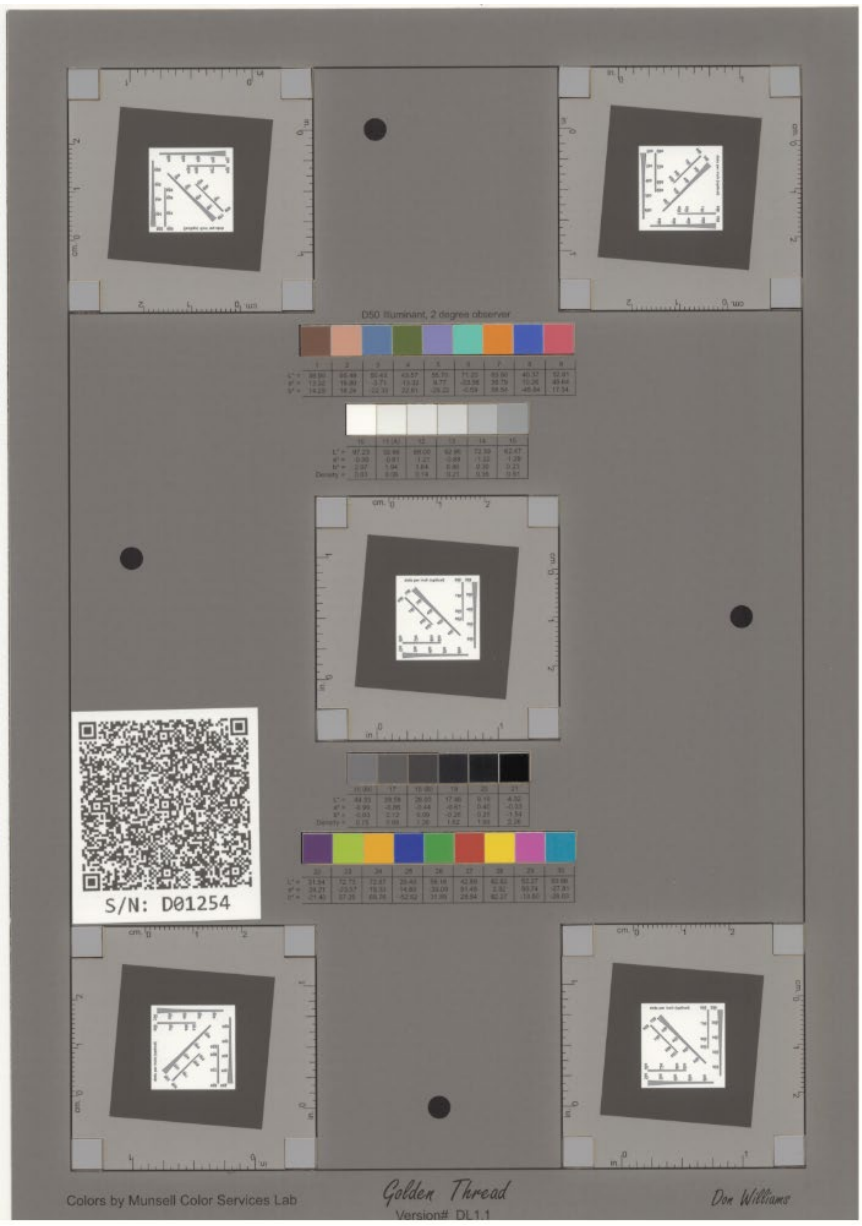


How it works

The HP FADGI scanning mode is compliant with the accuracy specifications in **Section 3.5: Documents (Unbound): Modern Textual Records** in the Technical Guidelines. Every scanned image's color and spatial image attribute accuracy are within Section 3.5 compliance specifications.

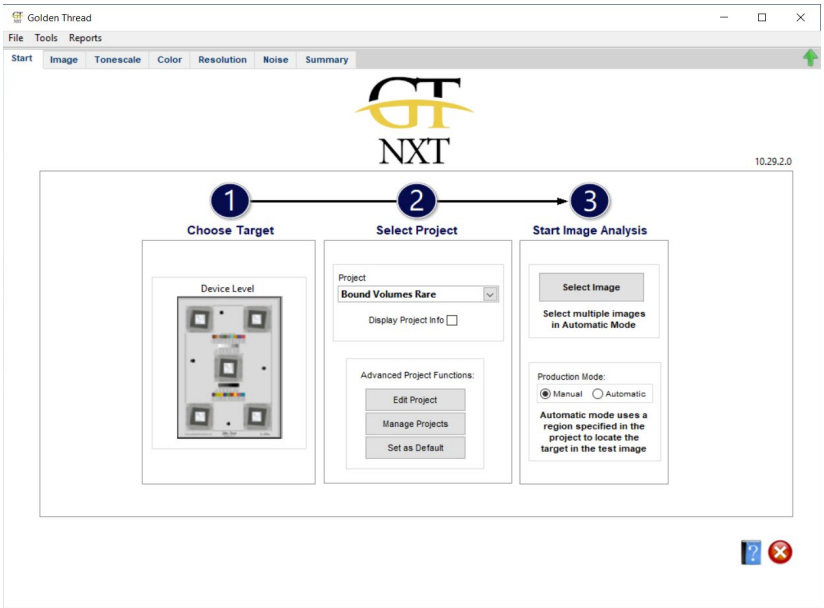
The DICE scanning target can be used to ensure that accuracy requirements are met. The DICE scanning target is designed for compliance measurement and certification. The screenshot below shows the DICE scanning target which can be purchased at the following link:

https://www.imagescienceassociates.com/goldenthread-device-dice-level-target.html



A commercially available software, Golden Thread NXT, and a free, publicly available software provided by the Library of Congress, OpenDICE, can be used for measurement and compliance certification. The screenshot below shows Golden Thread NXT which can be purchased at the following link:

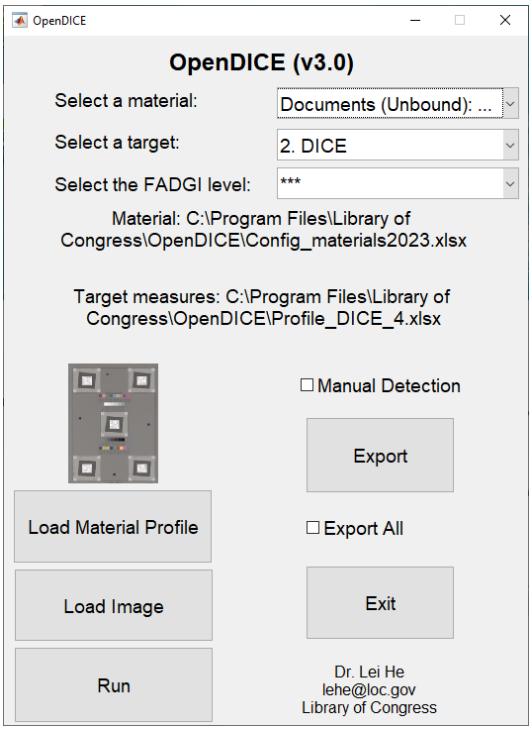
https://www.imagescienceassociates.com/goldenthread-nxt-software.html



The screenshot below shows OpenDICE, which can be downloaded at the following link:

https://www.digitizationguidelines.gov/guidelines/digitize-OpenDice.html.

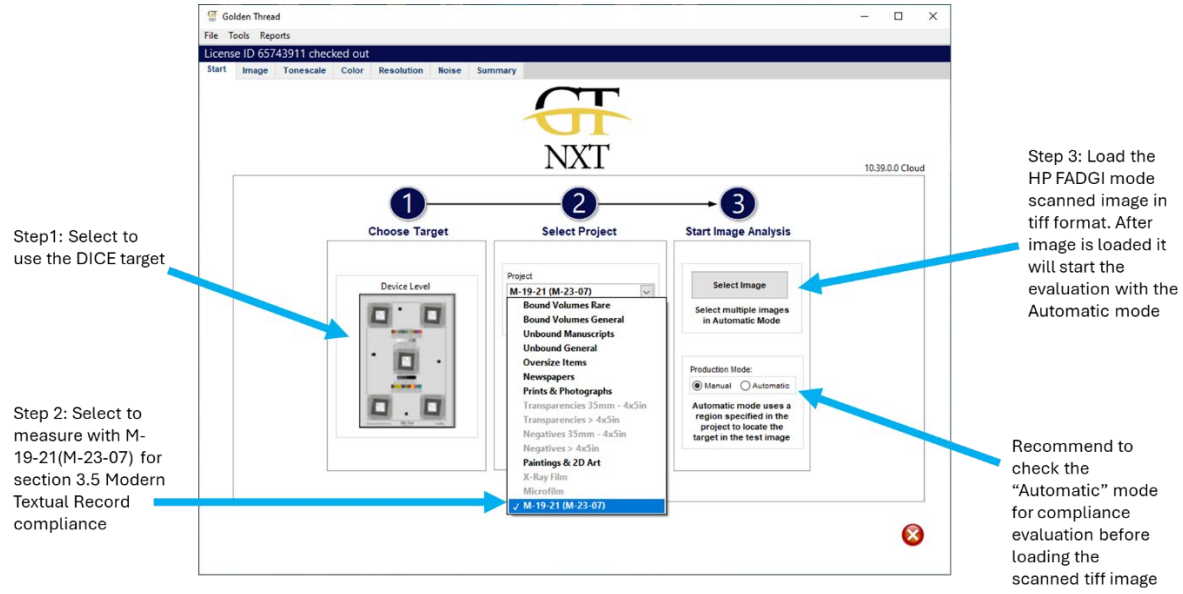
Refer to HP FutureSmart - Set up and Use FADGI Mode for more information.



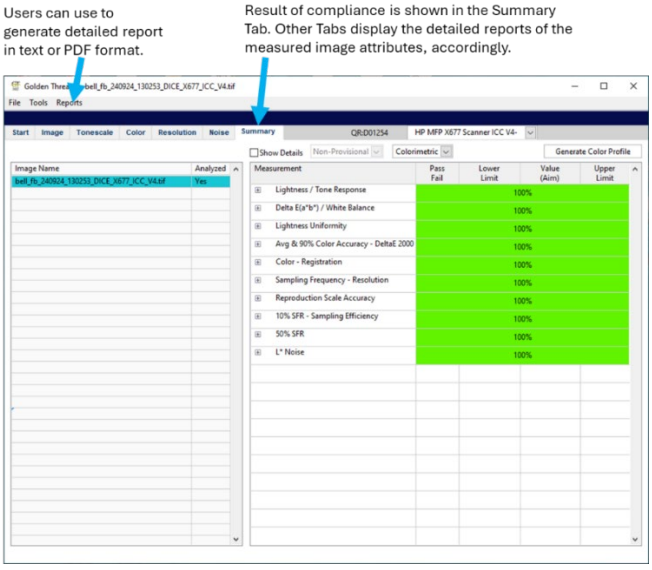
Note: The OpenDICE software offered by the Library of Congress does not specifically measure and certify FADGI **Section 3.5:** compliance. Instead, OpenDICE evaluates **Section 3.4: Document of Unbound General Collections** as a superset of specifications which include Section 3.5. For details, please refer to the FADGI Technical Guidelines and information on OpenDICE at the following link:

https://www.digitizationguidelines.gov/guidelines/digitize-OpenDice.html

The screenshot below shows the settings required to use Golden Thread NXT to measure **Section 3.5: Modern Textual Record** accuracy compliance.



The result of compliance measurement will be shown in the Summary tab with 100% compliance highlighted in green, as shown in the screenshot below, for every color and image attribute in Section 3.5: Modern Textual Record specification.



Customer Benefits

The FADGI initiative requires US Federal agency offices, or business entities working with US Federal agency offices, to manage, archive, and exchange digitally acquired imagery with a minimum of 3-star compliant accuracy. The HP digital sender and MFP Workflow service fleets equipped with license enabled FADGI scanning mode can meet the mandatory 3-star compliance requirements for HP customers of US Federal agency offices, or business entities working with US Federal agency offices.

For additional information regarding the mandatory 3-star compliance requirements, refer to the Technical Guidelines for Digitizing Cultural Heritage Materials at the following link:

shttps://www.digitizationguidelines.gov/guidelines/digitize-technical.html

Scanner Calibration

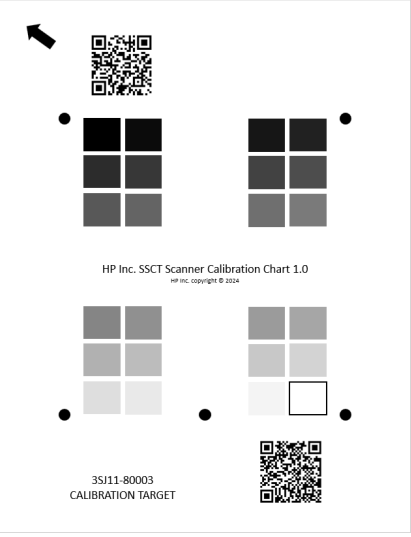
Before using FADGI mode to scan for the first time, HP recommends calibrating the scanner using the **Neutral Calibration** option to ensure the accuracy of compliance with FADGI Technical Guidelines.

Scanner calibrations might also be required on occasion to keep the scanner performing optimally with high-precision, repeatable scan quality output. Refer to **HP FutureSmart - Set up and Use FADGI Mode** for instructions on calibrating the scanner.

Scanner Neutral Calibration

The tone response of HP scanners may vary through the scanner life span. HP provides the method to calibrate the tone response. Users can find the calibration menu in “Support Tools > Maintenance > Calibration/Cleaning > FADGI Calibration Support” in the device UI. Refer to **HP FutureSmart - Set up and Use FADGI Mode** for more details.

To calibrate the scanning tone, SSCT Scanner Calibration Chart below is needed. The chart is provided by HP Inc.



Sharpness control

Sharpness varies depending on the Spatial Frequency Response (SFR) that is affected by external factors. If the SFR value is lower or higher than the minimum required, users can increase or decrease the sharpness level accordingly.

The calibration menu on the device UI can be found in "Support Tools > Maintenance > Calibration/Cleaning > FADGI Calibration Support > Sharpness Control." Refer to **HP FutureSmart - Set up and Use FADGI Mode** for more details.

Supported printers

The following HP Workflow Enterprise and Managed series can use the FADGI mode feature.

- HP Color LaserJet Enterprise X677
- HP Color LaserJet Managed MFP E73025, E73030
- HP Color LaserJet Managed MFP E73130, E73135, E73140
- HP Color LaserJet Managed MFP E78523, E78528
- HP Color LaserJet Managed MFP E78625, E78630, E78635
- HP Color LaserJet Managed MFP E82650, E82660, E82670
- HP Color LaserJet Managed MFP E87740, E87750, E87760, E87770
- HP Color LaserJet Enterprise MFP 5800
- HP Color LaserJet Enterprise MFP 6800
- HP Color LaserJet Enterprise MFP 6801
- HP Color LaserJet Enterprise X57945
- HP Color LaserJet Enterprise X58045
- HP Color LaserJet Enterprise X67755
- HP Color LaserJet Enterprise X67765

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