
HIMSS and RSNA
Integrating the Healthcare Enterprise

IHE/MESA Evidence Creator
Tests

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1 Evidence Creator Tests

1.1 Introduction

This document describes several tests for Evidence Creator systems. The Display Consistency tests are defined in a separate document: *Display Consistency Test Plan for Image Creator*.

1.1.1 Integration Profiles and Test Procedures

This document lists a number of tests for Evidence Creator Systems. You may not be responsible for all of these tests.

Please refer to the Connectathon web tool to list the required tests for your system. The web address of this tool depends on the year and project manager. Please contact the appropriate project manager to obtain this information.

1.2 Message Attributes

1.3 Message Values

1.4 Configuration

The MESA Image Manager maintains a database of DICOM applications used for C-Move operations. Add an entry for the storage SCP(s) associated with your workstation. Edit the text file `$MESA_TARGET/db/loaddicomapp.pgsql` (Unix) or `$MESA_TARGET/db/loaddicomapp.sql` (Windows NT) Use the existing entries as a template and add entries for your workstations as appropriate. The column names found in the SQL insert statements are described in the following table.

Column Name	Description
aet	DICOM Application Entity Title. Must be unique.
host	Host name (or IP address) of the application.
port	TCP/IP port number for receiving associations.
org	The organization that operates the device. Useful if multiple organizations use the Image Manager.
com	A comment field.

You can test your work as follows:

```
perl load_apps.pl imgmgr
```

The file `$MESA_TARGET/runtime/imgmgr/ds_dcm.cfg` is used to configure the MESA Image Manager. The only parameter users should change is the LOG_LEVEL value. Log levels are defined in section 1.5. DICOM configuration parameters are listed in the table below.

Application	AE Title	Port
MESA Image Manager	MESA_IMG_MGR	2350

Read the *Runtime Notes* section of the *Installation Guide* to determine the proper settings for the MESA runtime environment.

1.5 Starting the MESA Servers

These instructions assume you are using a terminal emulator on Unix systems or an MS DOS command window under Windows NT. Each test uses a command line interface; there is no graphical user interface. Before you start the test procedure, you need to start the MESA Image Manager servers. Make sure the appropriate database is running (PostgreSQL, SQL Server). To start the MESA servers:

1. Enter the Image Display exam folder: `$MESA_TARGET/ mesa_tests/rad/actors/imgcrt` or `$MESA_TARGET/ mesa_tests/card/actors/evdcrt`
2. Execute the appropriate script to start the servers:

```
scripts/start_mesa_servers.csh (Unix)
```

```
scripts\start_mesa_servers.bat (Windows)
```

Log levels are set for the MESA Image Manager in the file: `$MESA_TARGET/runtime/imgmgr/ds_dcm.cfg`. Log levels are:

- 0 no logging
- 1 errors
- 2 warnings
- 3 verbose
- 4 conversational (really verbose)

When you are finished running one or more tests, you can stop the servers:

```
scripts/stop_mesa_servers.csh (Unix)
```

```
scripts\stop_mesa_servers.bat (Windows)
```

Log files are stored in `$MESA_TARGET/logs`.

1.5.1 Starting Servers for Test 1701

The Test 1701 scripts are found in a different directory from the other Image Creator scripts. The Test 1701 scripts are in the evdcrt (evidence creator) directory, and use a slightly different server control procedures.

Before you start the test procedure, you need to start the MESA Image Manager servers. Make sure the appropriate database is running (PostgreSQL, SQL Server). To start the MESA servers:

3. Enter the Image Display exam folder: *\$MESA_TARGET/ mesa_tests/rad/actors/evdcrt*
4. Execute the appropriate script to start the servers:

```
perl scripts/mesa_servers.pl start
```

Log levels are as described in the section above.

When you are finished running one or more tests, you can stop the servers:

```
perl scripts/mesa_servers.pl stop
```

Log files are stored in *\$MESA_TARGET/logs*.

1.6 Submission of Results

Test descriptions below inform the reader to “submit results to the Project Manager”. This does not mean “email”. The current submission process should be documented by the Project Manager, but will not include emailing files directly to the Project Manager.

2 Individual Tests

2.1 Image Creator Test 500: Display Calibration

Image Creators supporting the Consistent Presentation of Images Integration Profile must calibrate their displays in accordance with DICOM PS 3.14. Instructions for this test are included in the document: *Display Consistency Test Plan for Image Creator*.

2.2 Image Creator Test 511: Key Image Note 511

In this test, the Image Creator will create a Key Image Note that refers to a single image from a series.

1. Create/modify the SQL script to identify the Image Creator under test.
2. Start the MESA servers as described above.
3. The steps below are run from the directory
`$MESA_TARGET/ mesa_tests/rad/actors/imgcrt.`
4. Load the data sets into the MESA Image Manager.

```
perl 5xx/load_img_mgr.pl
```
5. Retrieve the study for the patient CRTHREE^PAUL.
6. Create a Key Image Note with the parameters described below. Send the DICOM composite object to the MESA Image Manager.
7. Evaluate the contents of your Key Image Note as follows:

```
perl 511/eval_511.pl [-v]
```

If you need to send the note a second time, you should clear the MESA Image Manager first. This will allow the evaluation software to examine your latest object.

```
perl scripts/reset_servers.pl
```

Template Identifier	2010:DCMR	Required
Document Title	113000:DCM:Of Interest	Required
HAS CONC MOD	CODE 121049:DCM:Language of Content Item and Descendants = ISO369_2:eng:English	Optional
HAS OBS CONTEXT	CODE 121005:DCM:Observer Type = 121006:DCM:Person	Required
HAS OBS CONTEXT	PNAME 121008:DCM:Person Observer Name = MOORE^STEVE	Required
CONTAINS TEXT	113012:DCM:Key Object Description = Key Object Test 511	Required
Image Reference	Select the image with Image Number 16	Required

2.3 Image Creator Test 512: Key Image Note 512

In this test, Image Displays will create a Key Image Note that refers to two images from one series.

1. Create/modify the SQL script to identify the Image Creator under test.
2. Start the MESA servers as described above.
3. The steps below are run from the directory
\$MESA_TARGET/ mesa_tests/rad/actors/imgcrt.
4. Load the data sets into the MESA Image Manager.

```
perl 5xx/load_img_mgr.pl
```

5. Retrieve the study for the patient CTFIVE^JIM.
6. Create a Key Image Note with the parameters described below. Send the DICOM composite object to the MESA Image Manager.
7. Evaluate the contents of your Key Image Note as follows:

```
perl 512/eval_512.pl [-v]
```

If you need to send the note a second time, you should clear the MESA Image Manager first. This will allow the evaluation software to examine your latest object.

```
perl scripts/reset_servers.pl
```

Template Identifier	2010:DCMR	Required
Document Title	113007:DCM:For Patient	Required
HAS CONC MOD	CODE 121049:DCM:Language of Content Item and Descendants = ISO369_2:eng:English	Optional
HAS OBS CONTEXT	CODE 121005:DCM:Observer Type = 121006:DCM:Person	Required
HAS OBS CONTEXT	PNAME 121008:DCM:Person Observer Name = MOORE^STEVE	Required
CONTAINS TEXT	113012:DCM:Key Object Description = Key Object Test 512	Required
Image Reference	Select images with Image Number 67 and 68	Required

2.4 Image Creator Test 513: Key Image Note 513

In this test, Image Creators will create a Key Image Note that refers to two images; each from a different series.

1. Create/modify the SQL script to identify the Image Creator under test.
 2. Start the MESA servers as described above.
 3. The steps below are run from the directory
\$MESA_TARGET/ mesa_tests/rad/actors/imgcrt.
 4. Load the data sets into the MESA Image Manager.
-

```
perl 5xx/load_img_mgr.pl
```

5. Retrieve the study for the patient MRTHREE^STEVE.
6. Create a Key Image Note with the parameters described below. Send the DICOM composite object to the MESA Image Manager.
7. Evaluate the contents of your Key Image Note as follows:

```
perl 513/eval_513.pl [-v]
```

If you need to send the note a second time, you should clear the MESA Image Manager first. This will allow the evaluation software to examine your latest object.

```
perl scripts/reset_servers.pl
```

Template Identifier	2010:DCMR	Required
Document Title	113004:DCM:For Teaching	Required
HAS CONC MOD	CODE 121049:DCM:Language of Content Item and Descendants = ISO369_2:eng:English	Optional
HAS OBS CONTEXT	CODE 121005:DCM:Observer Type = 121006:DCM:Person	Required
HAS OBS CONTEXT	PNAME 121008:DCM:Person Observer Name = MOORE^STEVE	Required
CONTAINS TEXT	113012:DCM:Key Object Description = Key Object Test 513	Required
Image Reference	Select Image 9 from Series 103 Select Image 19 from Series 104	Required

2.5 Image Creator Test 521: Consistent Presentation of Images

This test is for Image Creators that support the Consistent Display of Images integration profile. Instructions for this test are found in the document *Display Consistency Test Plan for Image Creator*.

2.6 Image Creator Test 551: Example Image/GSPS Objects

The goal of this “test” is to provide samples for other vendors to display. You should send a “representative sample” of the data produced by your system.

The Scheduled Workflow integration profile only uses images and not presentation state objects. Therefore, Image Creator actors supporting the Scheduled Workflow integration profile should submit sample images.

GSPS objects are discussed/supported in the Consistent Presentation of Images integration profile. Image Creator actors create GSPS objects (requirement) and may optionally produce images. Image Creator actors that support the CPI integration profile should submit the GSPS objects they produce and any images produced. If you use images that are not part of the MESA test set as the basis for your GSPS objects, you should submit those, even if you did not produce them. That will allow other actors to display the original images and the appropriate GSPS objects.

Each system should send samples of the Image and/or GSPS objects that they create to the Image Manager. These are to be submitted in advance of the general date for test results to allow other vendors the opportunity to test with them. Please refer to the Project Manager web site for the due date.

1. Clear the MESA Image Manager of all data.
2. Send sample images/GSPS objects to the MESA Image Manager.
3. Tar or zip the files in \$MESA_STORAGE/imgmgr/instances and send them to the Project Manager (shipping instructions on Project Manager web page).

2.7 Image Creator Test 552: Example Key Image Note

As with test 551, the goal of this test is to send representative samples to the Project Manager for distribution to other vendors. These samples will be based on tests 511, 512, and 513.

1. After you complete tests 511, 512, and 513, locate the Key Image notes stored on the MESA Image Manager. These will be in \$MESA_STORAGE/imgmgr/instances. The first directory level is the Study Instance UID. You should recognize your Key Image Notes by the Series Instance UID used to identify the next directory.
2. Tar or zip the files holding your Key Image Notes and send them to the Project Manager (shipping instructions on Project Manager web page).

2.8 Image Creator Test 1412: PWF CT

Test 1412 is a test of the steps for Post Processing Workflow in a CT 3D reconstruction scenario. CT images will be created and a 3D reconstruction workitem will be scheduled. As an Image Creator, you will be asked to query for the post processing worklist and to claim the scheduled workitem. Subsequent post processing workflow steps are not yet implemented.

1. Run the active manager test script:

```
perl 1412/1412_imgcrt.pl
```
2. Follow the test instructions
3. Run the evaluation script:

```
perl 1412/eval_1412.pl
```

The evaluation script should yield 0 errors.

2.9 Evidence Creator Test 1700: Evidence Document Description

In the Evidence Documents profile, Evidence Documents are defined as DICOM SR objects that are to be used to assist in diagnosis. An example would be measurements on an Ultrasound device.

The purpose of this test is to make sure that Evidence Creators in the Evidence Documents profile understand the content they are to produce is contained in DICOM SR objects according to the Evidence Document Profile. As mentioned above, the most obvious example are Ultrasound measurements. Another example could be a Mammography CAD file. Evidence Documents (in the Evidence Document Profile) are not images, nor are they DICOM SR Diagnostic Reports.

The instructions below are not a joke. We have had experience with this profile indicating users do not understand the intent of the Evidence Documents profile.

1. Create a text file and answer the questions below:
 - a. What DICOM SOP class is used by your system to generate Evidence Documents? This should be a Structured Report Class.
 - b. Describe in 100-500 words why your documents are to be considered evidence and are not merely diagnostic reports or other SR objects.
 - c. Describe in 100-500 words what problems other vendors will have in rendering your document or incorporating your results in a diagnostic report.
 2. Name the text file using the convention: Vendor_1700.txt
 3. Submit the text file to the Project Manager for evaluation.
-

2.10 Evidence Creator Test 1701: Evidence Document Management in Scheduled Workflow

Test 1701 covers evidence document management in scheduled workflow, part of the Evidence Document profile. The test itself is an implementation of the scheme shown in Figure 14.2-1 (see IHE TF Vol I, section 14).

To run this test, be sure you are in the *\$MESA_TARGET/ mesa_tests/rad/actors/evdcrt* directory. Then, execute:

```
perl scripts/imgmgr_swf.pl 1701 <log>
```

To evaluate this test:

```
perl 1701/eval_1701.pl <log>
```

The evaluation script should yield 0 errors.

3 Nuclear Medicine Specific Tests

3.1 Evidence Creator Test 2801: NM Reconstructed Images Special Requirements

Reference: Rad TF-2: 4.18.4.1.2.3

In test 2801, reconstructed tomographic datasets are tested for these attributes:

```
0054 0022 Detector Information Sequence
>> 0020 0037 Image Orientation
0018 0088 Spacing Between Slices
```

3.2 Evidence Creator Test 2802: NM Reconstructed Images Cardiac Views

Reference: Rad TF-2: 4.18.4.1.2.3

In test 2802, reconstructed tomographic datasets are tested for these attributes:

```
0054 0220 View Code Sequence
0054 0500 Slice Progression Direction
0040 0555 Acquisition Context Sequence
```

3.3 Evidence Creator Test 2803: NM Result Export

Reference: Rad TF-2: 4.18.4.1.2.4

4 Cardiology Specific Tests

4.1 Evidence Creator Test 20605: Evidence Creation Cath

In this test, Evidence Creators will create a DICOM SR (evidence) using the cath option. The SR object is evaluated, although the contents of the template are not.

1. The steps below are run from the directory *\$MESA_TARGET/ mesa_tests/card/actors/evdrt*.
2. Edit the configuration file *ecvdrf.cfg* and make sure the DICOM AE title, host name and port number describe a DICOM Storage SCP for your system. In a step below, the script will push DICOM data to your system.
3. Start the MESA servers as described above.
4. Load the cath data set into your Evidence Creator.

```
perl 20605/load_data.pl
```

5. Create an Evidence Document with the parameters described below. Send the DICOM composite object to the MESA Image Manager.
6. Evaluate the contents of your Evidence Document as follows:

```
perl 20605/eval_20605.pl <log level>
```

where <log level> is a value between 1 (low) and 4 (high)

7. The evaluation output is found in *20605/grade_20605.txt*. Submit that file to the Project Manager for evaluation.

If you need to send the note a second time, you should clear the MESA Image Manager first. This will allow the evaluation software to examine your latest object.

```
perl scripts/reset_servers.pl
```

4.1.1 Evaluation Notes

These are notes intended to help the user know what is being tested.

Verify the following in the SR Template of one of the SR SOP Classes:

- Basic Text SR 1.2.840.10008.5.1.4.1.1.88.11
 - Enhanced SR 1.2.840.10008.5.1.4.1.1.88.22
 - Comprehensive SR 1.2.840.10008.5.1.4.1.1.88.33
 - Procedure Log Storage 1.2.840.10008.5.1.4.1.1.88.40
 - Mammography CAD SR 1.2.840.10008.5.1.4.1.1.88.50
 - Chest CAD SR 1.2.840.10008.5.1.4.1.1.88.65
-

The SR object should match the original image or worklist verbatim: (See App C of Rad Vol3)

- Referenced Study Component Sequence [2]
 - SOP Class UID
 - SOP Instance UID
- Study Instance UID
- Current Requested Procedure Evidence Sequence
 - references to all DICOM objects referenced in the content tree (parse content tree for any composite image or waveform entry, pick up the SOP Instance UID from that tree and make sure that it is in this Current Requested Procedure Evidence Sequence

Completion Flag (0040,A491) should be set (to some value)

Verify that one of the following Templates is used:

- 3001 Procedure Log
- 3202 Ventricular Analysis
- 3213 Quantitative Arterial Analysis
- 3250 Intravascular Ultrasound
- 3500 Hemodynamics
- 5100 Vascular Ultrasound
- 5200 Echocardiography
- 4000 Mammography CAD Document Root Template
- 5000 OB-GYN Ultrasound Procedure Report
- 3500 Hemodynamics Report
- 4100 Chest CAD SR Document Root Template
- 5100 Vascular Ultrasound Procedure Report Template

Evaluate composite objects using Agfa/Philips DVT and/or Clunie DICOM3TOOLS.

4.2 Evidence Creator Test 20606: Evidence Creation Echo

In this test, Evidence Creators will create a DICOM SR (evidence) using the echo option. The SR object is evaluated, although the contents of the template are not.

1. The steps below are run from the directory *\$MESA_TARGET/mesa_tests/card/actors/evdcrt*.
-

2. Edit the configuration file *ecvdrf.cfg* and make sure the DICOM AE title, host name and port number describe a DICOM Storage SCP for your system. In a step below, the script will push DICOM data to your system.
3. Start the MESA servers as described above.
4. Load the cath data set into your Evidence Creator.

```
perl 20606/load_data.pl
```

5. Create an Evidence Document with the parameters described below. Send the DICOM composite object to the MESA Image Manager.
6. Evaluate the contents of your Evidence Document as follows:

```
perl 20606/eval_20606.pl <log level>
```

where <log level> is a value between 1 (low) and 4 (high)

7. The evaluation output is found in 20606/grade_20606.txt. Submit that file to the Project Manager for evaluation.

If you need to send the note a second time, you should clear the MESA Image Manager first. This will allow the evaluation software to examine your latest object.

```
perl scripts/reset_servers.pl
```

4.2.1 Evaluation Notes

These are notes intended to help the user know what is being tested.

Verify the following in the SR Template of one of the SR SOP Classes:

- Basic Text SR 1.2.840.10008.5.1.4.1.1.88.11
- Enhanced SR 1.2.840.10008.5.1.4.1.1.88.22
- Comprehensive SR 1.2.840.10008.5.1.4.1.1.88.33
- Procedure Log Storage 1.2.840.10008.5.1.4.1.1.88.40
- Mammography CAD SR 1.2.840.10008.5.1.4.1.1.88.50
- Chest CAD SR 1.2.840.10008.5.1.4.1.1.88.65

The SR object should match the original image or worklist verbatim: (See App C of Rad Vol3)

- Referenced Study Component Sequence [2]
 - SOP Class UID
 - SOP Instance UID
 - Study Instance UID
 - Current Requested Procedure Evidence Sequence
-

- references to all DICOM objects referenced in the content tree (parse content tree for any composite image or waveform entry, pick up the SOP Instance UID from that tree and make sure that it is in this Current Requested Procedure Evidence Sequence)

Completion Flag (0040,A491) should be set (to some value)

Verify that one of the following Templates is used:

- 3001 Procedure Log
- 3202 Ventricular Analysis
- 3213 Quantitative Arterial Analysis
- 3250 Intravascular Ultrasound
- 3500 Hemodynamics
- 5100 Vascular Ultrasound
- 5200 Echocardiography
- 4000 Mammography CAD Document Root Template
- 5000 OB-GYN Ultrasound Procedure Report
- 3500 Hemodynamics Report
- 4100 Chest CAD SR Document Root Template
- 5100 Vascular Ultrasound Procedure Report Template

Evaluate composite objects using Agfa/Philips DVT and/or Clunie DICOM3TOOLS.

4.3 Evidence Creator Test Case 20640: Evidence Creation – Cath – Vendor Interoperability

Test 20640 tests the creation and content of an SR with a Cath template. The ED Profile assumes that the Evidence Creator is part of Cath Scheduled Workflow. Although the acquisition of a Cath Image is not part of the Evidence Documents Profile, the transactions are included here as test set up, but not explicitly tested. See the Radiology Technical Framework Volume 1:14 for a more complete explanation.

The purpose of this test is to collect SR object/cath templates from all Evidence Creator actors prior to the Connectathon. These vendors/actors are required to submit SR objects for every Cath template and SR SOP Class supported. These files should be submitted to the IHE web tool as part of the results of these tests. These files will be used by the Image Display vendors/actors as Test Case 20650. It is requested that this test, in particular, be completed at least one month in advance of the MESA test completion date to allow the Image Display actors to test the display of each of these objects and to allow time for communication if there is a problem.

MESA: There is no MESA software required for this test. See the Cardiology Transaction Sequences Test Plan for more test details.

The vendor should create a file using the naming convention of: CompanyName_Product_20640_EC_n_2005.doc , where n is any number to that you make up to differentiate the files if the SR Vendor has submitted multiple objects.

4.4 Evidence Creator Test Case 20641: Evidence Creation – Echo – Vendor Interoperability

Test 20641 tests the creation and content of an SR with an Echo template. The ED Profile assumes that the Evidence Creator is part of Echo Scheduled Workflow. Although the acquisition of an echo image is not part of the Evidence Documents Profile, the transaction is included here as test set up, but not explicitly tested. See the Radiology Technical Framework Volume 1:14 for a more complete explanation.

The purpose of this test is to collect SR object/cath templates from all Evidence Creator actors prior to the Connectathon. These vendors/actors are required to submit SR objects for every Echo template and SR SOP Class supported. These files should be submitted to the IHE web tool as part of the results of these tests. These files will be used by the Image Display vendors/actors as Test Case 20651. It is requested that this test, in particular, be completed at least one month in advance of the MESA test completion date to allow the Image Display actors to test the display of each of these objects and to allow time for communication if there is a problem.

MESA: There is no MESA software required for this test. See the Cardiology Transaction Sequences Test Plan for more test details.

The vendor should create a file using the naming convention of: CompanyName_Product_20641_EC_n_2005.doc , where n is any number to that you make up to differentiate the files if the SR Vendor has submitted multiple objects.
