Merge Unity™

12.0

DICOM CONFORMANCE STATEMENT-MEDIA STORAGE

IBM Watson Health™

INDICATIONS FOR USE: Merge Unity PACS

Merge Unity PACS is a medical image and information management system that allows viewing, selection, processing, printing, telecommunications, and media interchange of medical images from a variety of diagnostic imaging systems. Merge Unity PACS interfaces to various storage and printing devices using DICOM or similar interface standards.

Merge Unity PACS displays, stores, prints, and telecommunicates images from a number of medical modalities, including but not limited to MRI, CT, US, PET, DXA (bone densitometry), imaging, computed radiography, digital radiography, digitized films, digital photographs, mammographic images, and processed data from FDA-cleared third party image processing systems, including FDA-cleared systems for computer-aided detection and advanced image processing (e.g. 3-D processed images such as those produced by Voxar Corp.).

Lossy compressed mammographic images must not be used for primary diagnostic interpretation unless approved for use in digital mammography. Display monitors used for primary diagnostic interpretation of mammographic images must be approved for use in digital mammography.

INDICATIONS FOR USE: Z3D

Z3D is intended to provide reading physicians, referring physicians, and other appropriate healthcare professionals tools to aid in interpreting medical images, including:

- Displaying DICOM compliant medical image volumes, such as CT, MRI, and PET.
- Reformatting images, including creation of MPRs, MIPs, MinIPs, color/monochrome 3D volume rendered images.
- Manipulating displayed images via control of slice thickness, slice interval, obliquity, perspective, rotation, window/level, crop, zoom, color/monochrome transformations, segmentation, sculpting, straightening the display of curved structures, and creating images perpendicular to a curvilinear path.

- Creating series of DICOM images and individually captured images that can be displayed and stored in a PACS.
- Measuring coronary calcium, which is intended for non-invasive identification and quantification of calcified atherosclerotic plaques in the coronary arteries using tomographic medical image data and clinically accepted calcium scoring algorithms.

CAUTION: U.S. federal law restricts this device to sale by, or on the order of, a physician.
CAUTION: Unity PACS and Merge Z3D are not intended for diagnostic use on mobile device such as a phone or tablet.

Manufacturer's Address

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The symbols glossary is provided electronically at http://www.merge.com/Support/Statements-and-Patches.aspx.

For application support or to report issues with user documentation, contact Customer Support:

- Phone: 800-794-5955 Option 1
- Email: MergeSupport@us.ibm.com

DOCUMENT VERSION LOG

Document Number	Revision	Date	Description
UPAX-9471	1	24 January 2019	Initial release.
	2	11 April 2019	Rivisions throughout after Development review. Corrected copyright date in footers. Added DICOM edition.

For the latest revision of this document, go to Merge Communities.

Contents

1   Getting Started

Introduction

Purpose

This document is a DICOM Conformance Statement for DICOM interfaces of Merge Unity Media. Merge Unity provides media creation capability from several product lines and optional features, including Guardian, Media Ambassador, Network Media Ambassador, and PacsCube™. Merge Unity also provides media[1] reading capability. The contents of a DICOM Conformance statement are specified in the ACR/NEMA DICOM Standard Part 2: Conformance.

Merge Unity provides several products and optional components that serve as DICOM File Set Creators (FSCs). These products all create DICOM-compliant media. This document covers the following Merge Unity FSCs.

- Guardian
- Media Ambassador
- Network Media Ambassador
- PacsCube™

The Guardian provides the Merge Unity PACS with media storage and retrieval capabilities for archive, backup and import/export via media (such as a training disk) on CD and DVD media. Media Ambassador, Network Media Ambassador, and PacsCube™ are File Set Creators which create DICOM-compliant CD and DVD media.

All Merge Unity FSCs can be configured to write all images as DICOM SOP instances and to write a DICOMDIR file describing the studies on the media volume. If necessary, images that were not originally acquired in DICOM format are converted to DICOM SC (secondary capture) images. They can be configured to compress archived images. Media Ambassador, Network Media Ambassador, and PacsCube™ also provide the ability to uncompress images.

The Guardian capabilities described in this conformance statement facilitates the viewing of archived images by equipment from other manufacturers.

Media Ambassador, Network Media Ambassador, and PacsCube™ also provide the ability to create fully IHE media creator compliant CDs and DVDs.

Merge Unity provides functionality that serves as a DICOM File Set Reader (FSRs). This functionality is provided by the Universal Manager/Dominator application. Additionally, the Universal Manager provides the ability to import studies from DICOM compliant media as part of the FSR capability. This document covers the following Merge Unity FSRs

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[1] Media, in this instance, is limited to DICOM Compliant CDs and DVDs.

- Universal Manager

The Universal Manager provides the ability to view and import DICOM studies from DICOM compliant CDs and DVDs. The set of SOP Classes, Transfer Syntaxes and compressions supported is identical for both the reading and importing capability. Hence, they are not discussed separately.

Importing studies is only supported to DICOM SCPs.

Scope

The Guardian, Media Ambassador, Network Media Ambassador, and PacsCube™ all have additional capabilities that are described in their respective product documentation and are outside the scope of this conformance statement.

The FSR capability is only a small part of the full capability provided by the Universal Manager. Only details specific to the FSR capability of the Universal Manager are detailed in this document. All other features and capabilities are beyond the scope of this document.

This document describes the DICOM conformance of all media Merge Unity DICOM interfaces. A separate document, "Merge Unity Network Interfaces Conformance Statement" describes the conformance details of Merge Unity network interfaces.

Related Documentation

The following documents are referenced in this procedure:

Part Number	Document Title
UPAX-9472	Merge Unity 12.0 DICOM Conformance Statement Network Interfaces. *Needed to complete this procedure or is affected by tasks in this procedure.*
NEMA PS3 2018a	Digital Imaging and communications in Medicine (DICOM) Standard

Glossary

The following acronyms and abbreviations are used in this document.

ACR	American College of Radiology
AE	Application Entity
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
FSC	File Set Creator
FSR	File Set Reader
FSU	File Set Updater
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
NEMA	National Electrical Manufacturers Association
PACS	Picture Archival and Communications System

PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

Where not fully specified, media refers to CD and DVD media.

2   Implementation Model

FSR Implementation

FSR Implementation is provided for DICOM compliant media, specifically DVDs and CDs. Other types of media are not supported.

It is assumed that all media is fully DICOM compliant. Specifically, but not limited to, as defined by ACR/NEMA DICOM Specification, PS 3.12 Media Formats and Physical Media for Media Interchange.

Studies from DICOM compliant media may be viewed or imported as part of the FSR functionality.

Importing capability is facilitated only to DICOM SCPs, specifically the DIGATE SCP, an optional Merge Unity software component. The capabilities and functionality of DIGATE are beyond the scope of this document. Refer to the DICOM Network Interfaces Conformance Statement for Merge Unity PACS for details.

FSR Application Data Flow Diagram

| DICOM Compliant Media | Unity FSRs | Functionality |

```
                                                      ┌─────────────────┐
                                                      │ Import Study    │
                                                      │ to (DIGATE)     │
                                                      │ DICOM SCP       │
                                                      └─────────────────┘
 ┌──────────────┐        ┌──────────────────┐
 │ Media        │───────▶│ Universal Manager│
 │ (CDs/DVDs)   │        │                  │
 └──────────────┘        └──────────────────┘
                                                      ┌─────────────────┐
                                                      │                 │
                                                      │ View Images     │
                                                      └─────────────────┘
```
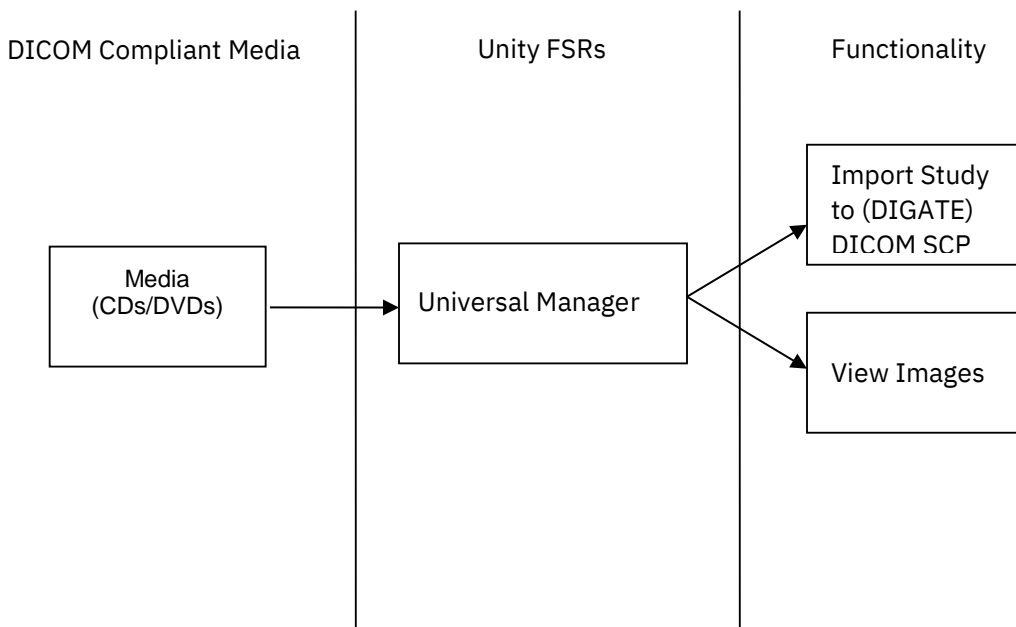
Figure 2-1 FSR Application Data Flow Diagram

Functional definition of Universal Manager/DIGATE

The Universal Manager is the main Merge Unity application. It provides the ability to view, copy and import studies as well as many other features, which are well beyond the scope of this document.

As it pertains to the FSR functionality, the Universal Manager is required to be configured to view or import studies from a Media Drive (CD or DVD).

Similarly, DIGATE is a full-featured SCP and the details of DIGATE's functionality are beyond the scope of this document.

However, since DIGATE is a DICOM SCP, a correctly configured DIGATE will automatically be configured to receive studies from DICOM compliant media and no further discussion is warranted.

FSC Implementation

All Merge Unity FSC creates CD-R media as described in ACR/NEMA DICOM Specification, PS 3.12 Media Formats and Physical Media for Media Storage, Annex F.

Merge Unity FSCs can be configured to apply compression to images as they are stored, use the existing/original compression, or uncompress the images. The selection of which images are compressed and what compression quality parameters are applied can be configured globally or be dependent on the image's modality.

Merge Unity software provides the ability to create images in a variety of ways:

- directly as a DICOM SOP instance
- video capture
- digitizing film

Unity FSCs provide support for converting non-DICOM images to DICOM Images. Non-DICOM images are converted into DICOM Secondary Capture images.

All Merge Unity FSCs write a DICOMDIR file.

Media created by Merge Unity FSCs may have additional information that is specific to Merge Unity, and should be ignored by File Set Readers that read the disk under the Application Profiles listed below.

FSC Application Data Flow Diagram
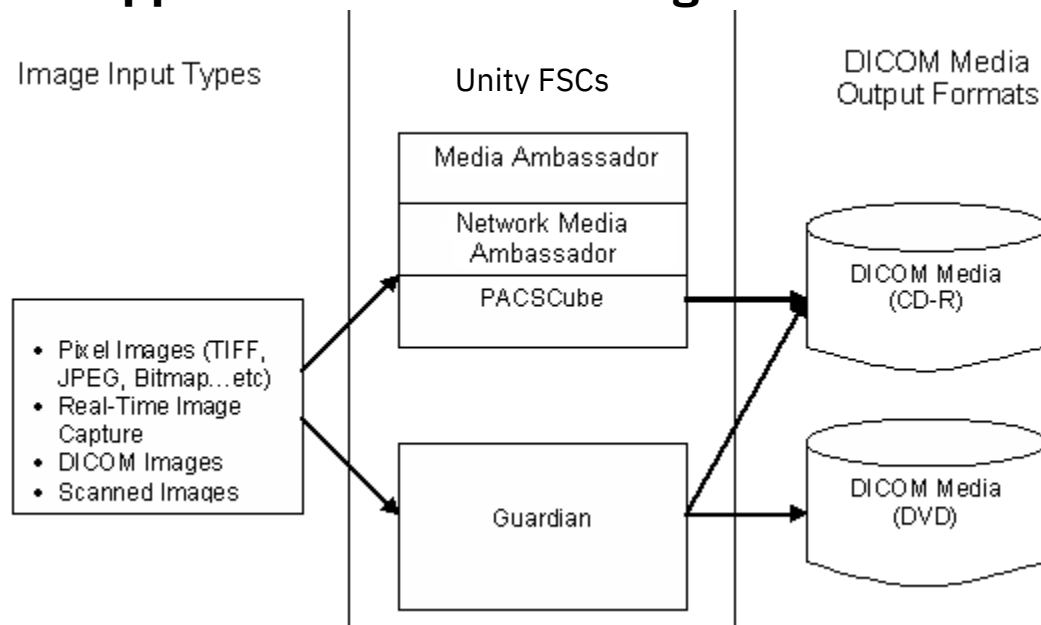
Figure 2-2 FSC Application Data Flow Diagram.

Functional definition of Guardian AE

Guardian has the ability to create storage media containing selected images. These studies may have been acquired directly from devices, received via Storage Service Class, or transferred from another Merge Unity PACS.

For the purpose of this conformance statement, Guardian acts as a File Set Creator (FSC).

Guardian identifies studies that have been selected for media storage. Guardian can be instructed to create either archive or backup disks. Studies on archive disks are identified in the system's archive database so that they can be rapidly retrieved for comparison with subsequent studies of the same patient. Backup disks are identical to archive disks except that they are not recorded in the archive database. Guardian can be configured to make multiple copies of either archive or backup disks, typically for off-site storage or for distribution (e.g. of a training disk).

The real-world activity of identifying which studies are to be written is external to Guardian, and outside the scope of this conformance statement. When Guardian is instructed to create an archive or backup disk, it recognizes those studies which have already been selected.

In the process of building a storage media volume, Guardian can optionally compress images. Images which were not acquired in DICOM format are converted to DICOM Secondary Capture images.

Functional definition of Media Ambassador/Network Media Ambassador/PacsCube™ AE

The Media Ambassador, Network Media Ambassador, and PacsCube™ AEs provide very similar functionality. The only major difference is in the physical mechanism that creates the DICOM compliant media. In the case of Media Ambassador a CD is burned directly on the workstation being used. In the case of Network Media Ambassador and PacsCube™, a remote CD burning mechanism is established.

However, in terms of DICOM media creation they are virtually identical and are hence discussed as a single entity.

All of these AEs provide the following capabilities:

- Image Conversion (Compression or Decompression, as applicable)
- Conversion of non-DICOM images to DICOM Secondary Capture
- Support for IHE-compliant media creation
- Full compliance with DICOM Part 10 specification
    - Including DICOMDIR creation and Group 0002 Meta headers.

File Meta Information for Implementation Class and Version

All Unity FSCs use the following implementation class UID:

Implementation Class UID = "2.16.840.1.113786.0.13"

3   AE Specifications

Universal Manager AE – Specification

Table 1 - AE Related Application Profiles, Real-World Activities, and Roles

Application Profiles Supported	Real World Activity	Role
STD-GEN-CD	Load Directory or File	FSR
STD-GEN-DVD-RAM	Load Directory or File	FSR

The Universal Manager acts as a File Set Reader (FSR) for DICOM compliant CDs and DVDs.

Only SOP Classes, compressions, and transfer syntaxes that are explicated stated in this document are supported. These SOP Classes, compressions, and transfer syntaxes are delineated in subsequent sections.

File Meta Information for the Universal Manager AE

Real-World Activities

Real-World Activity: View Study (Images) from a CD

The Universal Manager acts as an FSR through a user interface for a File load operation.

The AE will display images (from supported SOP Classes) in a manner consistent with normal viewing of DICOM studies.

It is assumed all media is DICOM part 10 compliant and contains a valid DICOMDIR file.

Media Storage Application Profile: STD-GEN-CD

The Universal Manager AE provides conformance to the General Purpose CD-R Image Interchange Profile.

DIGATE AE - Specification

The DIGATE AE provides the ability to import DICOM studies by serving as a DICOM SCP.

This capability is fully described in the DICOM Network Interfaces Conformance Statement for Merge Unity PACS document and is not discussed here.

Guardian AE - Specification

Table 2 - AE Related Application Profiles, Real-World Activities, and Roles

Application Profiles Supported	Real World Activity	Role	SC Option
STD-GEN-CD, AUG-GEN-DRS-CD	Create CD	FSC	Interchange

STD-GEN-DVD-RAM AUG-GEN-DRS-DVD-RAM	Create DVD	FSC	Interchange

Guardian acts as a File Set Creator for an augmented General Purpose CD-R Image Interchange Profile. The augmented profile provides for compressed images and for Implicit VR images.

NOTE: Guardian will not convert uncompressed Implicit VR images to uncompressed Explicit VR images.

Guardian can act as a File Set Creator for the standard General Purpose CD-R Image Interchange Profile by not employing image compression and (at installations that are configured to store images as Implicit VR) ensuring that Implicit VR images are not selected for archiving.

File Meta Information for the Guardian AE

The Guardian AE does not provide the Type 3 attribute Source Application Entity Title.

Real-World Activities

Real-World Activity: Create CD

The Guardian AE acts as an FSC using the Interchange option when writing an archive/backup CD or DVD.

The list of studies to be written is identified by other components of the system. Guardian displays this list. The user initiates the Real-World Activity Create CD by requesting either the "Create Archive CD" operation or the "Create Backup CD" operation. Guardian gathers the studies to be written and performs any necessary processing, such as compression. Guardian tracks space used and space available on the destination media. When either all selected studies have been gathered and processed or the data to be written will fill target media, a DICOMDIR is generated (space needed for the DICOMDIR is included in running space calculations) and the media is written. If "Create Archive CD" was selected, the archive database is updated to track the studies written to the disk volume. If additional copies of the media are configured, the user is prompted to insert a fresh blank CD or DVD, and the image is written again, repeating until the count has been met.

Guardian will not write a CD with no studies.

The Merge Unity Multi-Modality Application Profile is always applicable. Depending on Guardian configuration, General Purpose CD-R Image Interchange Profile can also be applicable.

Media Storage Application Profile: Common

These apply to all Application Profiles employed by the Guardian AE.

DICOM Directory

The Guardian AE writes directory records Patient, Study, Series and Image. Images are referenced via the Image Directory Entry attribute Referenced File ID (0004,1500). Guardian does not employ Multi-Referenced Directory Entries.

The complete description of supported DICOMDIR Keys is found in Appendix D DICOMDIR Information, page 32.

SOP Specific Conformance - Conversion to Secondary Capture

When conversion to Secondary Capture is required, a set of DICOM Tags must be generated to create a valid DICOM image. Refer to Appendix A Conversion to Secondary Capture, page 23, for the complete list of DICOM Tags that are created.

SOP Specific Conformance – Tag Coercion For Image Compression

If image compression (lossless or lossy) is applied during media creation, an additional set of DICOM tags will be coerced.

A full description of the process is found in Appendix B List of DICOM Tags Coerced for Image Compression, page 25.

Media Storage Application Profile: STD-GEN-CD

The Guardian AE provides conformance to the General Purpose CD-R Image Interchange Profile if Guardian's compression feature is not employed and studies containing images recorded under an Implicit VR Transfer Syntax are converted to VR Explicit.

The Guardian AE does not store Detached Patient Management Information Objects. Such support is "Optional" for FSC's in the General Purpose CD-R Image Interchange Profile specification.

Media Storage Application Profile: AUG-GEN-DRS-CD

The Guardian AE provides conformance to Merge Unity Multi-Modality Archive Application Profile, an augmented General Purpose CD-R Image Interchange Profile.

The Guardian AE does not store Detached Patient Management Information Objects. Such support is "Optional" for FSC's in the General Purpose CD-R Image Interchange Profile specification.

Media Storage Application Profile: STD-GEN-DVD-RAM

The Guardian AE provides conformance to the General Purpose DVD-RAM Media.

The DRS-specific details of the DVD-RAM support are identical to those of STD-GEN-CD Support in Media Storage Application Profile: STD-GEN-CD, page . 14

Media Storage Application Profile: AUG-GEN-DRS-DVD-RAM

The Guardian AE provides conformance to an augmented General Purpose DVD-RAM Image Interchange Profile.

The DRS-specific details of augmented DVD-RAM support are identical to those of Media Storage Application Profile: AUG-GEN-DRS-CD, page 14.

Media Ambassador / Network Media Ambassador / PacsCube™ AE - Specification

Table 3 - AE Related Application Profiles, Real-World Activities, and Roles

Application Profiles Supported	Real World Activity	Role	SC Option
STD-GEN-CD, AUG-GEN-DRS-CD	Create CD	FSC	Interchange

Media Ambassador, Network Media Ambassador, and PacsCube™ AEs act as File Set Creators for an augmented General Purpose CD-R Image Interchange Profile. The augmented profile provides for compressed images and for Implicit VR images.

File Meta Information for the Media Ambassador / Network Media Ambassador / PacsCube™ AEs

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs do not provide the Type 3 attribute Source Application Entity Title.

Real-World Activities

Real-World Activity: Create CD

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs act as an FSC using the Interchange option when writing an DICOM compliant CD or DVD.

The AEs can create DICOM CD for the following (based on user selection).

- A complete Exam (Study)

- A partial Exam

- Multiple Exams from the same patient,

- Multiple Exams from different patients (under special circumstances)

Implicit in the above list is that there is sufficient disk space to store the selected exam(s). Spanning exams across multiple disks is not supported.

Media Storage Application Profile: Common

These apply to all Application Profiles employed by the Media Ambassador / Network Media Ambassador / PacsCube™ AEs.

DICOM Directory

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs all write directory records Patient, Study, Series, Image, Presentation, Waveform, Key Object and Raw Data. SOP Instances are referenced via the Image Directory Entry attribute Referenced File ID (0004,1500). Multi-Referenced Directory Entries are not supported.

The complete description of supported DICOMDIR Keys is found in Appendix D DICOMDIR Information, page 32.

SOP Specific Conformance - Conversion to Secondary Capture

When conversion to Secondary Capture is required, a set of DICOM Tags must be generated to create a valid DICOM image. Refer to Appendix A Conversion to Secondary Capture, page 23, for the complete list of DICOM Tags that are created.

SOP Specific Conformance – Tag Coercion For Image Compression

If image compression (lossless or lossy) is applied during media creation, an additional set of DICOM tags will be coerced.

A full description of the process is found in Appendix B List of DICOM Tags Coerced for Image Compression, page 25.

SOP Specific Conformance – Additional DICOM Tag Coercion

When a CD is created by a Media Ambassador, Network Media Ambassador, or PacsCube™ AE, an additional set of DICOM Tags may be created or coerced.

These tags may be created or coerced prior to CD or DVD creation for the following reasons

- To guarantee globally unique UIDS
- To reflect most up to date Exam information
- To persist vital Unity-specific data (via Private Tags)
- To apply the correct image and/or window data for each image

The complete list of tags that may be coerced is listed in Appendix C List of (Potentially) Coerced DICOM Tags, page 28.

Note however that all tags are not guaranteed to be coerced or created.

Media Storage Application Profile: STD-GEN-CD

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs provide conformance to the General Purpose CD-R Image Interchange Profile if the compression feature is not employed and studies containing images recorded under an Implicit VR Transfer Syntax are converted to VR Explicit.

NOTE: Also, the Media Ambassador / Network Media Ambassador / PacsCube™ AEs provide the capability of creating fully IHE-compliant media, based on user selections.

Media Storage Application Profile: AUG-GEN-DRS-CD

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs provide conformance to Merge Unity Multi-Modality Archive Application Profile, an augmented General Purpose CD-R Image Interchange Profile.

The Media Ambassador / Network Media Ambassador / PacsCube™ AEs do not store Detached Patient Management Information Objects. Such support is "Optional" for FSC's in the General Purpose CD-R Image Interchange Profile specification.

4 Augmented and Private Profiles

Standard Profiles

General Purpose CD-R Image Interchange Profile: STD-GEN-CD

The General Purpose CD-R Image Interchange Profile specification requires the following table to specify the set of Composite Image and Stand-alone Storage SOP classes supported by the specific AE.

Table 4 - STD-GEN-CD SOP Classes and Transfer Syntaxes Supported by Unity FSC and FSR AEs

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Mandatory	Optional
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
X-Ray Angiographic	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement
X-Ray Radiofluoroscopic	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
X-Ray Angiographic BiPlane	1.2.840.10008.5.1.4.1.1.12.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
Detached Patient Management	1.2.840.10008.3.1.2.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional, not provided by Guardian	Optional	Optional

General Purpose DVD-RAM Image Interchange Profile: STD-GEN-DVD-RAM

The General Purpose DVD-RAM Image Interchange Profile specification supports an identical set of SOP Classes and Transfer Syntaxes as the STD-GEN-CD Profile. Refer to the previous table for details.

Augmented Profiles

Merge Unity Multi-Modality Archive Profile: AUG-GEN-DRS-CD

Merge Unity Multi-Modality Archive Application Profile is an augmented General Purpose CD-R Image Interchange Profile STD-GEN-CD. AUG-GEN-DRS-CD add support for default 8-bit and 12-bit JPEG Lossy Compression, lossy and lossless JPEG 2000 compression, and lossless JPEG compression. It also specifies optional support for Implicit VR Little Endian Uncompressed Transfer Syntax, for support of historical images at long-standing Unity DICOM installations. FSR's of disks created at installations that did not acquire DICOM images prior to Version 3.0 of the Dominator System will not need to support Implicit VR.

SOP Class Augmentations

The General Purpose CD-R Image Interchange Profile specification requires the following table to specify the set of Composite Image and Stand-alone Storage SOP classes supported by the specific AE. Hence, the table below includes both standard SOP classes as well as and augmentations.

Table 5 - AUG-GEN-CD SOP Classes and Transfer Syntaxes Supported by Unity FSC and FSR AEs

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
Digital Mammography Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Nuclear Medicine Image Storage (New)	1.2.840.10008.5.1.4.1.1.20	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Optional	Optional
X-Ray Angiographic	1.2.840.10008.5.1.4.1.1.12.1	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
X-Ray Radiofluoroscopic	1.2.840.10008.5.1.4.1.1.12.2	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
X-Ray Angiographic BiPlane	1.2.840.10008.5.1.4.1.1.12.3	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	All Transfer Syntaxes from Table 6	Mandatory	Optional	Optional
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	All Transfer Syntaxes from Table 6	Mandatory	Mandatory	Optional
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	All Transfer Syntaxes from Table 6	Optional	Optional	Optional
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional

Table 6 – AUG-GEN-DRS-CD Composite Image & Stand-alone Storage

Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement	Comments
Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory	
Implicit VR Little Endian Uncompressed 1.2.840.10008.1.2	Optional	Optional	Optional	Provided for storage of older studies.
JPEG Baseline (Process 1): Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression 1.2.840.10008.1.2.4.50	Mandatory	Mandatory	Optional	
JPEG Extended (Process 2 & 4): Default Transfer Syntax for Lossy JPEG 12 Bit Image Compression [Process 4 only] 1.2.840.10008.1.2.4.51	Mandatory	Mandatory	Optional	
Lossless, non-hierarchical, JPEG coding process 14 1.2.840.10008.1.2.4.57	Mandatory	Mandatory	Optional	

Transfer Syntax and UID	FSC Requirement	FSR Requirement	FSU Requirement	Comments
Lossless, non-hierarchical, first-order prediction, JPEG coding process 14 (selection value 1) 1.2.840.10008.1.2.4.70	Mandatory	Mandatory	Optional	
JPEG 2000 Lossless Image Compression 1.2.840.10008.1.2.4.90	Mandatory	Mandatory	Optional	
JPEG 2000 Lossy Image Compression 1.2.840.10008.1.2.4.91	Mandatory	Mandatory	Optional	
RLE Run Length Encoding (Lossless) 1.2.840.10008.1.2.5	Mandatory	Mandatory	Optional	

Merge Unity Multi-Modality Archive Profile: AUG-GEN-DRS-DVD-RAM

Merge Unity Multi-Modality Archive Application Profile also supports an augmented General Purpose DVD-RAM Image Interchange.

The AUG-GEN-DRS-DVD-RAM Profile supports an identical implementation of SOP Classes and Transfer Syntaxes to the AUG-GEN-DRS-CD Profile.

Refer to the previous section for details.

Appendix A.   Conversion to Secondary Capture

DICOM Tags Created

A set of DICOM Tags must be created when converting a non-DICOM image to Secondary Capture DICOM.

The table below is a list of the tags created. This list is independent of any other tag creation or coercion that may occur during the media creation process.

Table 7 - Secondary Capture DICOM Created Attributes

Tag	Attribute Name
(0002,0002)	Media Storage SOP Class UID
(0002,0003)	Media Storage SOP Instance UID
(0008,0008)	Image Type
(0008,0016)	SOP Class UID
(0008,0018)	SOP Instance UID
(0008,0020)	Study Date
(0008,0023)	Content Date
(0008,0030)	Study Time
(0008,0033)	Content Time
(0008,0060)	Modality
(0008,0064)	Conversion Type
(0008,0070)	Manufacturer
(0008,0080)	Institution Name
(0008,0081)	Institution Address
(0008,0090)	Referring Physician Name
(0008,1000)	Network ID
(0008,1010)	Station Name
(0018,1020)	Software Versions
(0008,1030)	Study Description
(0008,103E)	Series Description
(0008,1040)	Institutional Department Name
(0018,1050)	Spatial Resolution
(0008,1080)	Admitting Diagnosis Description
(0008,1090)	Manufacturer's Model Name
(0018,1200)	Date of Last Calibration
(0018,1201)	Time of Last Calibration
(0010,0010)	Patient's Name

Tag	Attribute Name
(0010,0020)	Patient ID
(0010,0030)	Patient's Birth Date
(0010,0040)	Patient's Sex
(0010,1010)	Patient's Age
(0010,4000)	Patient Comments
(0018,0022)	Scan Options
(0018,0023)	MR Acquisition Type
(0018,1000)	Device Serial Number
(0018,1010)	Secondary Capture Device ID
(0018,1012)	Date of Secondary Capture
(0018,1014)	Time of Secondary Capture
(0018,1016)	Secondary Capture Device Manufacturer
(0018,1018)	Secondary Capture Device Manufacturer's Model Name
(0018,1019)	Secondary Capture Device Software Versions
(0020,000D)	Study Instance UID
(0020,000E)	Series Instance UID
(0020,0010)	Study ID
(0020,0011)	Series Number
(0020,0012)	Acquisition Number
(0020,0013)	Instance Number
(0028,0120)	Pixel Padding Value
Private Tags may also be created as described in Appendix B List of DICOM Tags Coerced for Image Compression, page 25.	

Appendix B.   List of DICOM Tags Coerced for Image Compression

Standard Image Compression

Image compression, upon media creation, will result in the coercion of a number of attributes. When an image is compressed, the following image-related tags are coerced.

This coercion is in addition to any other tag creation/coercion that was required to create a DICOM compliant image and study.

Attribute Name	Tag	Comment
Samples per Pixel	(0028,0002)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, Samples per Pixel is coerced from 1 to 3.
Photometric Interpretation	(0028,0004)	If a color image is compressed, then the Photometric Interpretation is coerced as follows: JPEG YBR_FULL_422 JPEG 2000 lossy YBR_ICT JPEG 2000 lossless YBR_RCT JPEG Lossless RGB
Planar Configuration	(0028,0006)	If a color image is compressed, Planar Configuration is coerced to 0 (color-by-pixel).
Bits Allocated	(0028,0100)	If an image is compressed, Bits Allocated is coerced to reflect the compression technique.
Bits Stored	(0028,0101)	If an image is compressed, Bits Stored is coerced to reflect the compression technique.
High Bit	(0028,0102)	If an image is compressed, High Bit is coerced to reflect the compression technique.
Pixel Representation	(0028,0103)	If an image is compressed using JPEG, Pixel Representation is coerced to 0 (unsigned).
Red Palette Color Lookup Table Descriptor	(0028,1101)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped.
Green Palette Color Lookup Table Descriptor	(0028,1102)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped
Blue Palette Color Lookup Table Descriptor	(0028,1103)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped
Red Palette Color Lookup Table Data	(0028,1201)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped

Attribute Name	Tag	Comment
Green Palette Color Lookup Table Data	(0028,1202)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped
Blue Palette Color Lookup Table Data	(0028,1203)	If an image is compressed where the Photometric Interpretation (0028,0004) is PALETTE COLOR, this tag is dropped

Lossy Image Compression

The following table is a list of standard DICOM tags that are coerced when a lossy compression algorithm is applied. The tags are in addition to the tags listed in the table above for "Standard Image Compression".

Attribute Name	Tag	Comment
Image Type	(0008,0008)	If an image is compressed, then the Value 1 is coerced to DERIVED.
SOP Instance UID	(0008,0018)	A SOP Instance UID is generated and coerced
Derivation Description	(0008,2111)	If an image is compressed, Derivation Description is coerced to include compression history information. The existing contents (if any) will be prefixed with a line that begins "DRS:", and, if the attribute was not previously empty, ends with a new line character.
Source Image Sequence	(0008,2112)	Describes the image that was the source for this compressed image.
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.
Rescale Intercept	(0028,1052)	If an image is compressed with JPEG, it is necessary to scale the pixel domain to match that expected by the compression technique. In this case, Rescale Intercept and Rescale Slope are coerced to preserve the logical range of the output of the Modality LUT Module step in the DICOM pixel processing pathway. Hence, the parameters of the VOI LUT Module do not need to be adjusted as a result of compression.
Rescale Slope	(0028,1053)	See Rescale Intercept, above.
Smallest Pixel Value in Series	(0028,0108)	If an image is compressed, Smallest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Largest Pixel Value in Series	(0028,0109)	If an image is compressed, Largest Pixel Value in Series is coerced to the correct value if it can be computed, or dropped if it cannot.
Pixel Padding Value	(0028,0120)	If an image is compressed with lossy compression, this tag is dropped if present
Lossy Image Compression	(0028,2110)	If an image is compressed with lossy compression, this tag is added or coerced to 01 (Image has been subjected to lossy compression)
Lossy Image Compression Ratio	(0028,2112)	If an image is compressed with lossy compression, this tag is added if needed. If the tag exists, the lossy compression ratio is appended to the end. May be multivalued.
Lossy Image Compression Method	(0028,2114)	Applies only when lossy compression is applied. A list of lossy compressions that have been applied. May be multivalued, where new lossy compressions are appended ISO_10918_1 = JPEG Lossy Compression ISO_15444_1 = JPEG 2000 Irreversible Compression

Attribute Name	Tag	Comment
Modality LUT Sequence	(0028,3000)	If an image with a Modality LUT Sequence is compressed, the LUT is applied to the pixel data prior to compression, and the Modality LUT Sequence is removed from the compressed image.

The following table represents another list of tags that are coerced or created when a lossy compression algorithm is. This table displays the complete sequence information for the Source Image Sequence Tag (0008,2112) and the Derivation Code Sequence Tag (0008, 9215). For lossy compression, these tags are coerced in addition the tags in the previous table.

In this table, data contained within double quotes in the Comment section refer the actual value that is coerced for the corresponding tag attribute.

For each sequence, the sequence is created if none existed previously. If there was an existing sequence then a new item is appended to the end of the existing items.

Attribute Name	Tag	Comment
Source Image Sequence	(0008,2112)	For lossy compression, describes the image that was the source for this compressed image.
>Referenced SOP Class UID	(0008,1150)	SOP Class UID of the source image
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID of the source image
>Purpose of Reference Code Sequence	(0040,A170)	
>>Code Value	(0008,0100)	"121320"
>>Coding Scheme Designator	(0008,0102)	"DCM"
>>Code Meaning	(0008,0104)	"Uncompressed predecessor"
>>Context Identifier	(0008,010F)	"7202"
>>Mapping Resource	(0008,0105)	"DCMR"
>>Context Group Version	(0008,0106)	"20020904"
>>Context Group Extension Flag	(0008,010B)	"N"
Derivation Code Sequence	(0008,9215)	For lossy compression only, describes how this image was derived.
>Code Value	(0008,0100)	"113040"
>Coding Scheme Designator	(0008,0102)	"DCM"
>Code Meaning	(0008,0104)	"Lossy Compression"
>Context Identifier	(0008,010F)	"7203"
>Mapping Resource	(0008,0105)	"DCMR"
>Context Group Version	(0008,0106)	"20020904"
>Context Group Extension Flag	(0008,010B)	"N"

Appendix C.   List of (Potentially) Coerced DICOM Tags

DICOM Tag Coercion

The following tables present a list of DICOM Tags that may be coerced as part of the normal media creation process. All or any subset of the tags listed below may be created or coerced in the media creation process.

The UID related tags may be coerced to ensure complete UID uniqueness and valid SOP references, where appropriate.

The Private Tags are used to store DR-specific, vital data that cannot otherwise be stored in other DICOM Tags.

The rest of the Tags are coerced, as necessary, to provide a complete, DICOM-compliant study.

Table 8 – UID Related Tags

Tag	Name
(0002,0003)	Media Storage SOP Instance UID
(0008,0018)	SOP Instance UID
(0020,000D)	Study Instance UID
(0020,000E)	Series Instance UID
(0008,1155)	Referenced SOP Instance UID

Table 9 – Patient Related Tags

Tag	Name
(0010,0010)	Patient's Name
(0010,0020)	Patient ID
(0010,0030)	Patient's Birth Date
(0010,0040)	Patient's Sex
(0010,4000)	Patient Comments
(0008,1080)	Admitting Diagnosis Description
(0010,1010)	Patient's Age

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Table 10 – Study Level Related Tags

Tag	Name
(0008,0020)	Study Date
(0008,0030)	Study Time
(0008,0050)	Accession Number
(0008,0090)	Referring Physician's Name
(0008,1030)	Study Description
(0008,1060)	Name of Physician(s) Reading Study
(0020,0010)	Study ID

Table 11 – Windows Level Related Tags

Tag	Name
(0028,1050)	Window Center
(0028,1051)	Window Width
(0028,1055)	Window Center & Width Explanation

Table 12 – Equipment/Institution Level Related Tags

Tag	Name
(0008,0070)	Manufacturer
(0008,0080)	Institution Name
(0008,0081)	Institution Address
(0008,1000)	Network ID
(0008,1010)	Station Name
(0018,1020)	Software Version(s)
(0008,1040)	Institutional Department Name
(0018,1050)	Spatial Resolution
(0008,1090)	Manufacturer's Model Name
(0018,1200)	Date of Last Calibration
(0018,1201)	Time of Last Calibration
(0028,0120)	Pixel Padding Value

Table 13 – Series Level Related Tags

Tag	Name
(0008,0021)	Series Date
(0008,0031)	Series Time
(0008,0060)	Modality
(0008,103E)	Series Description
(0020,0011)	Series Number

(0028,0108)	Smallest Pixel Value in Series
(0028,0109)	Largest Pixel Value in Series

Table 14 – Secondary Capture Related Tags

Tag	Name
(0008,0060)	Modality ~~Override Series Value~~
(0008,0064)	Conversion Type
(0018,0022)	Scan Options
(0018,0023)	MR Acquisition Type
(0018,1010)	Secondary Capture Device ID
(0018,1012)	Date of Secondary Capture
(0018,1014)	Time of Secondary Capture
(0018,1016)	Secondary Capture Device Manufacturer
(0018,1018)	Secondary Capture Device Manufacturer's Model Name
(0018,1019)	Secondary Capture Device Software Versions

Table 15 – Image Related Tags

Tag	Name
(0008,0008)	Image Type
(0008,0023)	Content Date
(0008,0033)	Content Time
(0008,2111)	Derivation Description
(0008,2112)	Source Image Sequence
(0008,9215)	Derivation Code Sequence
(0020,0013)	Instance Number
(0020,0020)	Patient Orientation
(0028,0002)	Samples per Pixel
(0028,0004)	Photometric Interpretation
(0028,0006)	Planar Configuration
(0028,0100)	Bits Allocated
(0028,0101)	Bits Stored
(0028,0102)	High Bit
(0028,0103)	Pixel Representation
(0028,0106)	Smallest Image Pixel Value ~~i~~
(0028,0107)	Largest Image Pixel Value
(0028,0110)	Smallest Image Pixel Value in Plane

Tag	Name
(0028,0111)	Largest Image Pixel Value in Plane
(0028,1101)	Red Palette Color Lookup Table Descriptor
(0028,1102)	Green Palette Color Lookup Table Descriptor
(0028,1103)	Blue Palette Color Lookup Table Descriptor
(0028,1201)	Red Palette Color Lookup Table Data
(0028,1202)	Green Palette Color Lookup Table Data
(0028,1203)	Blue Palette Color Lookup Table Data
(0028,2110)	Lossy Image Compression
(0028,2112)	Lossy Image Compression Ratio
(0028,2114)	Lossy Image Compression Method
(0028,3000)	Modality LUT Sequence

Table 16 – Private Tags

Tag	Name
(4453,0010)	Private Creator
(4453,1001)	DR Exam ID
(4453,1002)	DR Image Type
(4453,1004)	DR File Type
(4453,1005)	DR File Suffix
(4453,100a)	DR Annotation Type
(4453,100c)	DR Original Instance UID Sequence

Appendix D. DICOMDIR Information

DICOMDIR Creation

The following tables are the supported DICOM Directory structure keys.

All supported DICOM objects have the following structure in common. Additional information on individual objects is listed in subsequent sections. Only tags for which current and accurate information exists will be created. However, all mandatory DICOM keys will be created and initialized.

Patient-Level Keys (i.e. where Directory Record Type is 'PATIENT')

Attribute Name	Tag	Comments
Patient's Name	(0010,0010)	
Patient ID	(0010,0020)	
Patient's Birth Date	(0010,0030)	
Patient's Sex	(0010,0040)	

Study-Level Keys (where Directory Record Type is 'STUDY')

Attribute Name	Tag	Comments
Study Date	(0008,0020)	
Study Time	(0008,0030)	
Accession Number	(0008,0050)	
Referring Physician's Name	(0008,0090)	
Study Description	(0008,1030)	
Name of Physician(s) Reading Study	(0008,1060)	
Study Instance UID	(0020,000D)	
Study ID	(0020,0010)	

Series-Level Keys (where Directory Record Type is 'SERIES')

Attribute Name	Tag	Comments
Modality	(0008,0060)	
Series Description	(0008,103E)	
Series Instance UID	(0020,000E)	
Series Number	(0020,0011)	

The following table lists the common keys for all the Objects referenced by a particular Series, independent of the value of the Directory Structure Record Type (0004,1430). Additional keys that relate to specific DICOM Object types are listed in the following sections.

Additional, Common Keys

Attribute Name	Tag	Comments
Referenced File ID	(0004,1500)	
Referenced SOP Class UID in File	(0004,1510)	
Referenced SOP Instance UID in File	(0004,1511)	
Referenced Transfer Syntax UID in File	(0004,1512)	
SOP Instance UID	(0008,0018)	
Instance Number	(0020,0013)	

Image Objects

For DICOM Images, in addition to the keys listed in the previous section, the following keys are also set. Again, it is not guaranteed that all keys listed will be created and initialized. Keys are created and initialized only if current and accurate information is available for that key. All mandatory DICOM keys will be created and initialized.

DICOM Images are identified by the Directory Structure Record Type (0004,1430). If the value for this key is 'IMAGE' then the referenced DICOM object is a DICOM Image. For this case, the following Image-Level keys are created.

Image-Level Keys (where Directory Record Type is 'IMAGE')

Attribute Name	Tag	Comments
Image Type	(0008,0008)	
Referenced Image Sequence	(0008,1140)	Only appears if present in image object. DRS-created images do not use this attribute.
>Referenced SOP Class UID	(0008,1150)	Present if and only if Referenced Image Sequence (0008,1150) is present.
>Referenced SOP Instance UID	(0008,1155)	Present if and only if Referenced Image Sequence (0008,1150) is present.

Basic Voice Audio Waveform Objects

Basic Voice Audio Waveform Storage Objects will create the following keys, in addition to those listed in Section DICOMDIR Creation.

Basic Audio Waveform Objects are identified by the Directory Structure Record Type (0004,1430). If the value for this key is 'WAVEFORM' then the referenced DICOM object is a Basic Audio Waveform Object. For this case, the following keys are created. Mandatory keys are always created. Optional keys are created if current and accurate information exists.

Waveform-Level Keys (where Directory Record Type is 'WAVEFORM')

Attribute Name	Tag	Comments
Content Date	(0008,0023)	
Content Time	(0008,0033)	

Key Object DICOM Objects

Key Object DICOM Objects will create the following keys, in addition to those listed in Section DICOMDIR Creation.

Key Object DICOM Objects are identified by the Directory Structure Record Type (0004,1430). If the value for this key is 'KEY OBJECT DOC' then the referenced DICOM object is a Key Object DICOM Object. For this case, the following keys are created. Mandatory keys are always created. Optional keys are created if current and accurate information exists and is relevant.

Key Object-Level Keys (where Directory Record Type is 'KEY OBJECT DOC')

Attribute Name	Tag	Comments
Content Date	(0008,0023)	
Content Time	(0008,0033)	
Concept Name Code Sequence	(0040,A043)	
Content Sequence	(0040,A730)	

Raw Data DICOM Objects

Raw Data Storage Objects will create the following keys, in addition to those listed in Section DICOMDIR Creation.

Raw Data Objects are identified by the Directory Structure Record Type (0004,1430). If the value for this key is 'RAW DATA' then the referenced DICOM object is a Raw Data Object. For this case, the following keys are created. Mandatory keys are always created. Optional keys are created if current and accurate information exists.

Raw Data-Level Keys (where Directory Record Type is 'RAW DATA')

Attribute Name	Tag	Comments
Content Date	(0008,0023)	
Content Time	(0008,0033)	
Icon Image Sequence	(0088,0200)	These items are not currently supported or required.
> Image Pixel Module		

Presentation State DICOM Objects

Presentation State Objects will create the following keys, in addition to those listed in Section DICOMDIR Creation.

Presentation State Objects are identified by the Directory Structure Record Type (0004,1430). If the value for this key is 'PRESENTATION' then the referenced DICOM object is a Presentation State Object. For this case, the following keys are created. Mandatory keys are always created. Optional keys are created if current and accurate information exists.

Presentation State-Level Keys (where Directory Record Type is 'PRESENTATION')

Attribute Name	Tag	Comments
Content Label	(0070,0080)	
Content Description	(0070,0081)	
Presentation Creation Date	(0070,0082)	
Presentation Creation Time	(0070,0083)	
Content Creator's Name	(0070,0084)	
Referenced Series Sequence	(0008,1115)	
> Series Instance UID	(0020,000E)	
> Referenced Image Sequence	(0008,1140)	
>> Referenced SOP Class UID	(0008,1150)	
>> Referenced SOP Instance UID	(0008,1155)	