

DAR-9400f
**DICOM Conformance Statement
with Gateway Option**

Revision A

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1. Introduction

1.1. Purpose of This Document

The purpose of this document is to describe how *DAR-9400f* (with Gateway option) conforms to the DICOM standard. It describes what parts and definition it utilizes and in what way, in order to provide interoperability with other devices that claim same conformance.

1.2. Sources for This Document

American College of Cardiology –National Manufactures Association (ACR-NEMA) Digital Imaging and Communications V2.0
ACR-NEMA Digital Imaging and Communications in Medicine (DICOM) v3.0, 2006.

1.3. Acronyms and Abbreviation

The following acronyms and abbreviations are used in this document.

- ACR American College of Radiology
- ACSE Association Control Service Element
- AE Application Entity
- ANSI American National Standards Institute
- AP Application Profile
- API Application Programming Interface
- ASCII American Standard Code for Information Interchange
- DICOM Digital Imaging and Communications in Medicine
- DIMSE DICOM Message Service Element
- DIMSE-C DICOM Message Service Element-Composite
- DIMSE-N DICOM Message Service Element-Normalized
- FSC File Set Creator
- FSR File Set Reader
- FSU File Set Updater
- GUI Graphical User Interface
- NEMA National Electrical Manufacturers Association
- PDU Protocol Data Unit
- RWA Real World Activity
- SCP Service Class Provider
- SCU Service Class User
- SOP Service Object Pair
- TCP/IP Transmission Control Protocol/Internet Protocol
- UID Unique Identifier
- MPPS Modality Performed Procedure Step
- PPS Performed Procedure Step
- PS Presentation State

1.4. Note to Reader

- **Interoperability**

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a networked environment may require application functions that are not specified within the scope of the DICOM standard. Consequently, using only the information provided by this conformance statement does not guarantee interoperability of Shimadzu Equipment with other vendor's equipment. It is the user's responsibility to thoroughly analyze the application requirements and to specify a solution that integrates Shimadzu equipment with the projected other vendor's equipment.

- **Validation**

Although Shimadzu equipment has been completely tested to verify that the implementation of the DICOM interface for this product corresponds with this Conformance Statement, even if comparison of respective Conformance Statement indicates that successful interconnection should be possible with another vendor's equipment, additional validation will always be necessary to ensure full functionality. It is the responsibility of the user to specify the appropriate test suite and to carry out the additional validation tests.

- **Version of the DICOM standard**

Shimadzu is committed to evolve with the DICOM standard as it adapts to meet the future requirement of users and technology. In order to do so, Shimadzu reserves the right to adapt and even discontinue delivery of its equipment. The user should ensure that any vendor whose equipment is connected to Shimadzu equipment also adapts to future version of the DICOM standard. If not, enhancement of Shimadzu may lead to loss of connectivity or interoperability.

2. Implementation Model

2.1. DAR-9400f

DAR-9400f is an acquisition and review station used for an angiographic image in the Cardiology environment.

The application, upon user request, will:

1. Acquire images from a CathLab and encapsulate them to the DICOM Standard Format.
2. Issue **C-ECHO** command to a remote DICOM SCP.
3. Issue **C-STORE** command to configured SCP in order to archive the acquired images.
4. Issue **C-MOVE** command to configured SCP.
5. Query (**C-FIND**), retrieve (**C-MOVE**) and display XA images from a remote DICOM SCP.
6. Read and display XA images from DICOM CD.
7. Act as FSC for DICOM CD. Write DICOM conformant CD-R
8. Act as FSR for DICOM CD. Read and display XA images from a DICOM conformant CD-R.
9. Query Modality Worklist (C-FIND)
10. Print the images to remote DICOM SCP printer.

2.2. Gateway

Gateway is an option for *DAR-9400f* image transfer system. *DAR-9400f* sends the image to the Gateway, edit the image properly and send it to the set SCP.

2.3. Application Data Flow Diagram

2.3.1. DAR-9400f

(1) Verification

DAR-9400f can send **C-ECHO** verifications.

(2) Basic Worklist Management or IHE Worklist Management

DAR-9400f will issue a **C-FIND** for the hospital Worklist.

(3) Find

DAR-9400f will issue a **C-FIND** command to a remote SCP to retrieve information about the studies stored on the remote SCP.

(4) Move Images

DAR-9400f will issue a **C-MOVE** command to a remote SCP to copy study information from one SCP to another or from a remote SCP to itself.

(5) Store Images as SCP

DAR-9400f will receive process and accept **C-STORE** command from a remote SCU and if the association succeeds, it will store the received data on its physical storage space.

(6) Store Images as SCU

DAR-9400f or Gateway will issue a **C-STORE** command to a remote SCP. If the association is successful it will send images for storage on the remote SCP.

(7) MPPS Management

DAR-9400f will issue an **N-CREATE** event to notify the creation of a new acquisition study and issue an **N-SET** event when this acquisition study is completed.

(8) Print

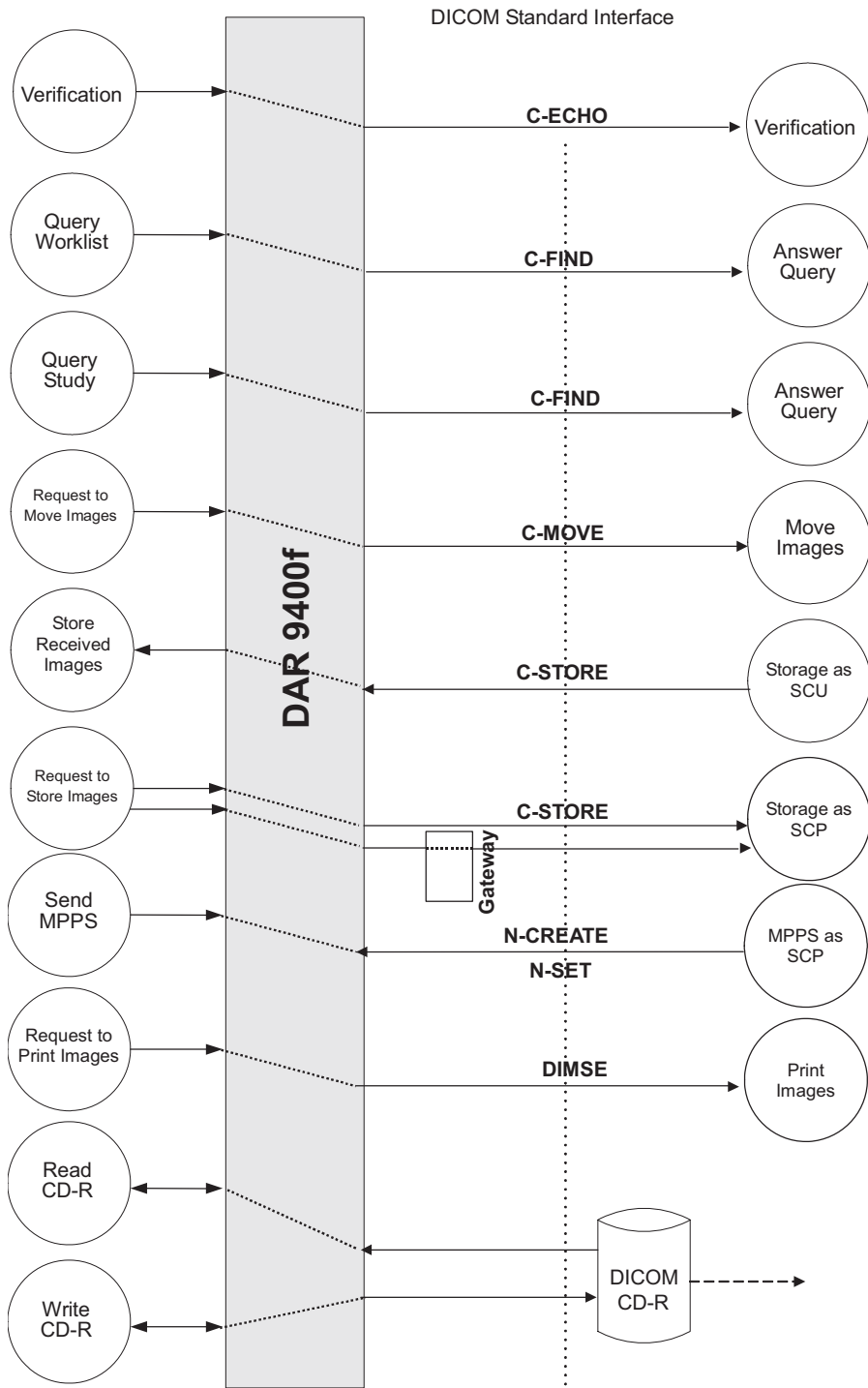
DAR-9400f will print an image or loop of images to the remote DICOM SCP printer.

(9) Read CD-R

DAR-9400f will read any DICOM conformant CD-R although it will only display compatible images.

(10) Write CD-R

DAR-9400f will write a DICOM conformant CD-R for the supported SOP classes.



2.4. Functional Description of AE's

(1) DAR-9400f

The *DAR-9400f* AE acts as a SCU and a SCP.

- If configured, *DAR-9400f* can query for the patient Worklist. The list of scheduled patient will be presented to the user and all fields in the patient demographic entry forms will be filled with the chosen patient. If all mandatory fields cannot be filled a form will be presented to the user with the missing fields highlighted. *DAR-9400f* will issue a **C-Find** request to retrieve Worklist information from a remote Modality Worklist SCP.
- *DAR-9400f* is a system designed to acquire images coming from the FPD of a catheterization laboratory. The system then compresses these images and transmits these compressed images over the network to a remote server that will place them in a safe place for long-term archive and retrieval.
- If configured to do so, when a study is terminated, *DAR-9400f* will send a command to the remote server to move images to one or more secondary destinations. The move may involve all the images objects of a study or only specific images belonging to one or more series. There may be any number of secondary destinations. When "Secondary Destination" is/are configured, *DAR-9400f* will issue a C-MOVE command to the server configured as "Primary Server" using either "Move by study" or "Move by Series" UID. The command will contain the "Primary Server" as origin and the "Secondary destination" as destination.
- *DAR-9400f* will issue a C-FIND command to get and display the content of a STORAGE-SCP remote server; it will then issue a C-MOVE command at study root level to the same server to transfer the selected image data proposing itself as destination.
- *DAR-9400f* will issue DIMSE-N set command to print SCP to print the image.
- *DAR-9400f* will issue a C-STORE command to a configured remote SCP to store images previously read from a DICOM CD.
- *DAR-9400f* will read data from a DIOCM CD that is present in its CD drive when requested to do so by the user
- *DAR-9400f* will accept association from remote SCU and accept and process C-STORE commands for DICOM Data Object of the allowed SOP classes.

2.5. Sequencing of Real World Activity

The storage Verification is done when a study is closed, and only if files for the study have been transmitted for storage to a remote SCP.

The Storage verification is done after the current study is closed.

The physical CD-R writing can only occur after an empty CD-R is inserted in the drive.

3. AE Specifications

3.1. DAR-9400f AE Specification

DAR-9400f provides Standard Conformance to the following DICOM V3.0 SOP Class as an SCU.

Table 1 Verification SOP Class as SCU

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Study Root Query/Retrieve IM Find	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2
XA – X-ray Angiographic image storage	1.2.840.10008.5.1.4.1.1.12.1
Secondary Capture Image storage	1.2.840.10008.5.1.4.1.1.7
Modality Worklist SOP class	1.2.840.10008.5.1.4.31
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9

3.1.1. Association Establishment Policies

3.1.1.1. General

The following Application Context Name will be proposed and recognized by *DAR-9400f*

- DICOM 3.0 Application Context **1.2.840.10008.3.1.1.1**

3.1.1.2. Number of Associations

The maximum number of association accepted or maintained by *DAR-9400f* is limited only by the physical memory of the machine on which it runs. Typically it can be up to 10. However, only 1 of it will be sent from Gateway.

3.1.1.3. Asynchronous Nature

DAR-9400f allows a single outstanding operation on any association. Therefore, *DAR-9400f* does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

3.1.1.4. Implementation Identifying Information

DAR-9400f will respond with the following implementation identifying parameters:

Implementation Class UID (acquisition) **1.2.392.200036.9110.13.XXXXXXXXXXXXXX**

Implementation Class UID (review) **1.2.392.200036.9110.14.XXXXXXXXXXXXXX**

The last number of the implementation class UID is the 13 digits maximum machine serial number.

Implementation Version Name **VOYAGER_VX_X_X**

Where X_X_X is the software version

The implementation version name policies are the following: product name “**VOYAGER**” followed by the version of the product, “**_v1_0_0**”.

When send the image via Gateway, it will respond with the following implementation identification parameters: 1.2.392.200036.9110.1.0.6711.2000731

Implementation version name is: SRVP-REC2.10

3.1.2. Association Initiation by Real World Activity

3.1.2.1. Real World Activity – Verification

(1) Associated Real World Activity – Verification

DAR-9400f will send C-ECHO to verify the other systems if they are activated.

(2) Presentation context Table – Verification

DAR-9400f supports the transfer syntaxes listed in Table 2. For a **Verification** request, *DAR-9400f* supports the Presentation Contexts listed in Table 2.

Table 2 Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

(3) SOP Specific conformance – Verification

DAR-9400f provides the standard conformance to the DICOM Verification SOP class.

3.1.2.2. Real World Activity – Query Study

(1) Associated Real World Activity – Query Study

DAR-9400f will issue a **FIND** request when a user of *DAR-9400f* wishes to view patient and study information from a remote DICOM SCP.

(2) Presentation context Table – Query Study

DAR-9400f supports the transfer syntaxes listed in Table 3. For a **QUERY** request, *DAR-9400f* supports the Presentation Contexts listed in Table 3.

Table 3 Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

(3) SOP Specific conformance – Query Study

DAR-9400f uses Relational query with Study root level by default. If the extended negotiation is not successful, it uses Relational query with Patient root level by default. If the extended negotiation still does not succeed, *DAR-9400f* will use Hierarchical query with patient root model.

➤ Matching key attribution

DAR-9400f Request matching of the following key attributes.

Table 4 Matching Key Attributes - Study Root Query/Retrieve Information Model *

Attribute Name	Type	Tag
STUDY LEVEL		
Study Date	R	(0008,0020)
Accession Number	R	(0008,0050)
Patient's Name	R	(0010,0010)
Patient ID	R	(0010,0020)
SERIES LEVEL		
Modality	R	(0008,0060)

* User can input these items on the monitor as a search key.

3.1.2.3. Real World Activity - Move Images

(1) Associated Real World Activity – Move Images

DAR-9400f will issue a MOVE request when a user of *DAR-9400f* wishes to move one or more studies from a remote DICOM SCP back to *DAR-9400f* (retrieve) or another remote DICOM SCP.

(2) Presentation context Table – Move

DAR-9400f supports the transfer syntaxes listed in Table 5. For a **MOVE** request, *DAR-9400f* supports the Presentation Contexts listed in Table 5 and Table 6.

Table 5 Move Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 6 Move Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
Study Root Query/Retrieve IM Move	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

(3) SOP Specific Conformance – Move

DAR-9400f uses specific keys for Move operation. When doing a series move the Study UID and Series UID are used as keys. When doing a study move only the Study UID is used as key.

3.1.2.4. Real World Activity – Request to Store Images

(1) Associated Real World Activity – Storage as SCU

DAR-9400f will issue a **Storage** request when a user of *DAR-9400f* wishes to send a study of images to a remote DICOM SCP.

(2) Presentation context Table – Storage as SCU

DAR-9400f supports the transfer syntaxes listed in Table 7.

Table 7 Worklist Presentation Context

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless, hierarchical, first order prediction	1.2.840.10008.1.2.4.70		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless, hierarchical, first order prediction	1.2.840.10008.1.2.4.70		

(3) Storage Presentation Contexts selection

- Transfer syntax can be configured. They can be enabled/disabled and the presented order can be selected
- If no Transfer syntax are selected in the option then the system try to negotiate the default Transfer Syntax (Original Storage Transfer Syntaxes) and Implicit VR Little Endian Transfer Syntax.

3.1.2.5. Real World Activity – Query Worklist

(1) Associated Real World Activity – Query Worklist as SCU

DAR-9400f will issue a **query Worklist** request when a user of *DAR-9400f* opens a new study if a Modality Worklist SCP is configured in its host table.

(2) Presentation context Table – Query Worklist as SCU

DAR-9400f supports the transfer syntaxes listed in Table 8. For a **Query Worklist** request, *DAR-9400f* supports the Presentation Contexts listed in. Table 8.

Table 8 Worklist Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

(3) SOP Specific Conformance – general purpose Worklist SOP Class as SCU
DAR-9400f supports queries against the Worklist Information Model using the baseline **C-FIND SCU** behaviour.
 Also, *DAR-9400f* supports the character sets that are indicated on section “4.4 Support for Extended Character Sets”.

- *DAR-9400f* Request matching of the following key attributes

Table 9 Matching Key Attributes - Query Worklist*

Attribute Name	VR	Tag
Scheduled Procedure Step Module		
Scheduled Procedure Step Sequence	SQ	(0040,0100)
>Modality**	CS	>(0008,0060)
>Scheduled Station AE Title	AE	>(0040,0001)
>Scheduled Procedure Step Start Date	DA	>(0040,0002)
>Scheduled Performing Physician's Name	PN	>(0040,0006)
Requested Procedure Module		
Requested Procedure ID	SH	(0040,1001)
Imaging Service Request Module		
Accession Number	SH	(0008,0050)
Patient Identification Module		
Patient's Name	PN	(0010,0010)
Patient ID	LO	(0010,0020)

* User can input these items on the monitor as a search key.

** Always searching with XA.

- *DAR-9400f* supports the character sets listed in Table 19.

3.1.2.6. Real World Activity – Request to Print Images

(1) Associated Real World Activity

DAR-9400f will issue a **Print** request when the user wants to send study images to the remote DICOM printer SCP.

(2) Presentation context Table – Request to Print Images

DAR-9400f supports the transfer syntaxes listed in Table 11. For a **Print** request, *DAR-9400f* supports the Presentation Contexts listed in **Table 10**.

Table 10 Request to Print Images Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

(3) SOP Specific Conformance

DAR-9400f provides the standard conformance to the DICOM Basic Grayscale Print Management Meta SOP class.

3.1.2.7. Real World Activity – Create a new acquisition study

(1) Associated Real World Activity – create a new acquisition study

DAR-9400f will issue an MPPS N-CREATE event when a user of *DAR-9400f* creates a new study in acquisition, if a PPS Manager is configured in its host table.

(2) Presentation context Table – MPPS N-CREATE

DAR-9400f supports the transfer syntaxes listed in Table 11 for MPPS N-CREATE event, *DAR-9400f* supports the Presentation Contexts listed in Table 12.

Table 11 MPPS N-CREATE Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 12 MPPS N-CREATE Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Modality Performed Procedure Step SOP class	1.2.840.10008.3.1.2.3.3	all from Table 11	SCU	None

3.1.2.8. Real World Activity – Close a study in acquisition

(1) Associated Real World Activity – close a study in acquisition

DAR-9400f will issue an MPPS N-SET event when a user of *DAR-9400f* closes a study in acquisition, if a PPS Manager is configured in its host table.

(2) Presentation context Table – MPPS N-SET

DAR-9400f supports the transfer syntaxes listed in Table 13 for MPPS N-SET event; *DAR-9400f* supports the Presentation Contexts listed in Table 14.

Table 13 MPPS N-SET Transfer Syntaxes

Transfer Syntax	UID
DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2

Table 14 MPPS N-CREATE Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Modality Performed Procedure Step SOP class	1.2.840.10008.3.1.2.3.3	all from Table 13	SCU	None

3.1.3. Association Acceptance Policy

3.1.3.1. Real World Activity - Store Received Images

(1) Associated Real World Activity – Store Received Images

DAR-9400f will archive images that are sent from **C-STORE SCU**.

(2) Presentation Context Table – Store Received Images

DAR-9400f supports the following transfer syntaxes listed in Table 15.

Table 15 Storage Transfer Syntaxes

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Class	SOP Class UID	Name List	UID List		
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless, hierarchical, first order prediction	1.2.840.10008.1.2.4.70		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless, hierarchical, first order prediction	1.2.840.10008.1.2.4.70		

DAR-9400f returns one of the following status codes (Table 16).

Table 16 Storage status codes

Service Status	Further Meaning	Protocol Codes	Related Fields	Description
Refused	Out of resources	A700		Indicates that there was not enough storage space to store the image. Recovery from this condition is left to the administrative functions available in <i>DAR-9400f</i> .
	SOP Class not supported	A800		Indicates that the SOP Class of the Image in the C-Store operation did not match the Abstract Syntax negotiated for the Presentation Context.
Error	Data set does not match SOP Class	A900		Indicates that the Data Set does not encode an instance of the SOP Class specified.
	Failed	C000		The operation was not successful.
	Cannot understand	C005		Indicates that the Data Set cannot be parsed into elements by <i>DAR-9400f</i> .
Warning	Coercion of data elements	B000		Data elements were modified before being stored.
	Data set does not match SOP Class	B007		Indicates that the Data Set does not match the SOP Class, but that the image was stored anyway.
	Elements Discarded	B006		Indicates that some of the elements of the Data Set were discarded.
	Duplicate SOP Instance UID	D000		Indicates that the SOP Instance UID of the specified image is already stored in the database.
Success	Success	0000		Operation performed properly.

(3) Presentation Context Acceptance Criterion – Store Received Images

DAR-9400f will accept any number of **Storage** Presentation Contexts per association request. Any one Abstract Syntax may be specified more than once in an association request, if the Transfer Syntaxes differ between the Presentation Contexts.

The acceptable Presentation Contexts which *DAR-9400f* may accept are specified in Table 15. *DAR-9400f* will examine proposed Presentation Contexts in the order proposed. The first acceptable Presentation Context (other than Verification) determines the Abstract Syntax which will be used for the association.

3.2. DAR-9400f Storage Media Application Profile Conformance Statement

DAR-9400 Media Storage AE conforms to following application profiles.

Table 17 Supported Application Profile

Supported APS	Real World Activity	Role	SC Option
DAR-9400f	Read CD-R	FSR	Interchange
	Write CD-R	FSC	Interchange

3.2.1. Real World Activity - Read CD

The *DAR-9400f* acts as a DICOM FSR with Interchange Service Class Option for images of SOP class in Table 18.

Table 18 Supported SOP classes as FSR

SOP Class	SOP Class UID
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
Secondary Capture Image storage	1.2.840.10008.5.1.4.1.1.7

3.2.1.1. Media Storage Application Profile

Read CD-R applies the following profile.

Table 19 Supported Application Profile for Read CD-R

Supported APS	Real World Activity	Role	SC Option
DAR-9400f	Read CD-R	FSR	Interchange

3.2.1.2. Real World Activity - Write CD

The *DAR-9400f* acts as a DICOM FSC with Interchange Service Class Option for images of SOP class in Table 20.

Table 20 Supported SOP classes as FSR

SOP Class	SOP Class UID
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
Secondary Capture Image storage	1.2.840.10008.5.1.4.1.1.7

3.2.1.3. Media Storage Application Profile

Write CD-R applies the following profile

Table 21 Supported Application Profile for Write CD-R

Supported APS	Real World Activity	Role	SC Option
DAR-9400f	Write CD-R	FSC	Interchange

4. Communication Profiles

DAR-9400f Gateway provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM standard.

4.1. TCP/IP Stack

DAR-9400f Gateway inherits its TCP/IP stack from the computer upon which it executes.

4.1.1. Physical Media Support

DAR-9400f Gateway is indifferent to the physical medium over which TCP/IP executes; it inherits the medium from the system upon which it executes.

4.2. Extensions/Specialization/Privatization

NA

4.3. Configuration

4.3.1. AE Title/Presentation Address Mapping

DAR-9400f maps the Application Entity titles to host name and port number via an internal configuration method. The mapping can be accessed in the configuration menu under the Database tab. Only a privileged user can change the mapping.

DAR-9400f is connected to network via a router. There are 2 or 3 computers running behind the router, and each computer could be as Storage SCU and Storage Commitment SCU.

There is also a computer for Gateway and it could be as Storage SCU.

Therefore, the same IP addresses, up to 4 AE titles and ports settings might be needed for the system which implements the service class SCP.

For other service class, only one computer could be SCU, so an IP address and AE title should be set.

4.3.2. Configurable Parameters

DAR-9400f Gateway receives its configuration parameters from the user through the AE's GUI.

Configurable parameters are:

1. Local/remote application entity title
2. Local/remote host IP address
3. Local/remote TCP/IP port
4. MAX PDU size
5. Time out for association
6. Route number of study, series, and imageUID
7. Destination of transfer (It is possible for each image, and this is only for Gateway)
8. Switching the output of live image and sub image in DSA (This is only for Gateway)

4.4. Support for Extended Character Sets

DAR-9400f is known to support the following character sets:

Table 22 Supported Character Sets

ISO-IR 100 (default)	Latin Alphabet No. 1
ISO-IR 6	Basic G0 Set
ISO-IR 87	Japanese

5. UID Generation

This section will describe how UID are generated by the *DAR-9400f* Gateway system. Gateway has specification of UID generation in different mode, and only one of them can be used at the same time.

5.1. Types of Generated Images

The system generates the following images.

X-ray Angiographic Image¹

DA image	: X-ray radiography image (Live image) which is used for cardiac catheterization examination.
3D-DA,3D-DSA image	: X-ray image (Live image) acquired by rotating the C-arm for 3D reconstruction.
DSA image:	: Subtraction image (Live image) which is used for such as head region study ² .
Reference image	: Reference image that represents a selected 1 frame of X-ray radiography image.

Secondary Capture Image

Photo File	: Still image file which is captured from the X-ray radiography image.
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5.2. Basic Specification

This section describes the specification of *DAR-9400f* without Gateway.

5.2.1. Definitions

Serial Number:	A thirteen digit maximum, number unique to this type of system (<i>DAR-9400f</i>).
Study Date:	Date in format YYYYMMDD at which the study was created.
Study Time:	Time in format HHMMSS at which the study was created.
Instance Date:	Date in format YYYYMMDD at which the image was created.
Instance Time:	Time formatted HHMMSS.
Instance MS:	The milliseconds portion of the time at which the image was created in format mmm.

Series Number³: Type of the encoding/object:

- 1: DA image (Lossless)
- 2: DA image (Lossy Cine)
- 13: Photo File
- 15: Reference image,
- 51: DSA image (Lossless Cine)
- 53: DSA image (Lossy Cine)

Instance Number⁴: Sequential Number of the DICOM object generated by the *DAR-9400f* for all objects of the same type in the same study.

¹Depending on the system configuration and radiography program, images will be either single-plane or bi-plane image for DA and DSA image.

²This is a live image normally, however, subtracted image can be sent when using Gateway.

³Correspond to 0020,0011 (Series Number).

⁴Correspond to 0020,0013 (Instance Number).

5.2.2. Root and Implementation Class UID

DAR-9400f root is 1.2.392.200036.9110

Acquisition station: Implementation Class UID = <Root>.13.<Serial Number>

Review station: Implementation Class UID = <Root>.14.<Serial Number>

For the Anonymize function:

This root is used only when competitor's files are being anonymized. Otherwise, the above roots are used.

DAR-9400f Root for anonymization = <Root>.66

Acquisition station: Implementation Class UID = <Root>.66.13.<Serial Number>

Review station: Implementation Class UID = <Root>.66.14.<Serial Number>

5.2.3. Study UID⁵

Study Instance UID = <ImplementationClassUID>.<StudyDate>.<StudyTime>

5.2.4. Series UID

Series Instance UID = <StudyInstanceUID>.<SeriesNumber>

5.2.5. SOP Instance UID

The Instance sequential number is a number that is generated by the *DAR-9400f* sequentially for each new sequence of the same type in a study.

1- DA, DSA, 3D-DA, 3D-DSA images

<SeriesInstanceUID>.<Instance Number>

2- Photo File

<ImplementationClassUID>.<InstanceDate>.<InstanceTime>.<SeriesNumber>.<InstanceMS>

3- Reference image

<ImplementationClassUID>.<InstanceDate>.<InstanceTime>.<SeriesNumber>.<InstanceMS>

4- Anonymized image

<ImplementationClassUID(anonymize)>.<SerialNumber>.<InstanceDate>.<InstanceTime>.<SeriesNumber>.<InstanceMS>

⁵Use acquired UID when acquiring via MWM.

5.3. Renumber Series by Shot Order Mode

This section describes the rules for generating UID when operating in this mode with Gateway.

5.3.1. Series Number

Image	Series Number
DA, DSA, 3D-DSA images	Frontal image: Instance Number *2-1 Lateral image: Instance Number *2
Photo File	2013
Reference image	2015

5.3.2. Series Instance UID

- Change the Series Number as in the table above during UID of original image.
- Change the “System Number” to “System Number. 9”.

5.4. Unified Series Number Mode

This section describes the rules for generating UID when operating in this mode with Gateway.

5.4.1. Series Number

Change as the following table.

Image	Series Number
DA, DSA	“1” as uniform number.
SC	“1” as uniform number.
Ref	“1” as uniform number.

5.4.2. Series Instance UID

- Set as same value as the Study Instance UID.
- Change the “System Number” to “System Number. 9”.

5.5. Change Series Instance UID Mode

This section describes the rules for generating UID when operating in this mode with Gateway.
(This mode is related to Photo File transfer. Basic specification is applied to the other images.)

5.5.1. Series Instance UID

- Generate the Series Instance UID for each plane and shot.
- To be specific, acquire the value of 0008,1155 Referenced SOP Instance UID in 0008,1140:Referenced Image Sequence of the original image, and overwrite the value “System Number” which is changed to “System Number.9” to the Series Instance UID.

5.6. Sort by Shot Order Mode

This section describes the rules for generating UID when operating in this mode with Gateway.
(This mode is related to Photo File transfer. Basic specification is applied to other images.)

5.6.1. Series Number

- Set the Series Number as follows for the Instance Number N of original image.

Frontal: $2N-1+100$

Lateral: $2N+100$

5.6.2. Instance Number

- Set the Instance Number to (0008,1160) Reference Frame Number.

5.6.3. Series Instance UID

- Set the “System Number” to “System Number. 9”
- Change the Series Number as the table above.

6. Information Object Definitions

DICOM tags in each image are listed as follows. (This conformance is described on DAR-9400f Ver2.1.6)

6.1. X-ray Angiographic Image

6.1.1. Dicom Meta Information

Tag	VR	Type	Attribute Name	Remarks
(0002,0000)	UL	1	Group 0002 Length	
(0002,0001)	OB	1	File Meta Information Version	
(0002,0002)	UI	1	Media Storage SOP Class UID	
(0002,0003)	UI	1	Media Storage SOP Instance UID	
(0002,0010)	UI	1	Transfer Syntax UID	
(0002,0012)	UI	1	Implementation Class UID	
(0002,0013)	SH	3	Implementation Version Name	
(0002,0016)	AE	3	Source Application Entity Title	

6.1.2. Patient Module

Tag	VR	Type	Attribute Name	Remarks
(0010,0010)	PN	2	Patient's Name	
(0010,0020)	LO	2	Patient ID	
(0010,0030)	DA	2	Patient's Birth Date	
(0010,0040)	CS	2	Patient's Sex	

* For DA and DSA, those images would be Single-plane or Bi-plane image depending on the system configuration and radiography program.

6.1.3. General Study Module

Tag	VR	Type	Attribute Name	Remarks
(0020,000D)	UI	1	Study Instance UID	
(0008,0020)	DA	2	Study Date	
(0008,0030)	TM	2	Study Time	
(0008,0050)	SH	2	Accession Number	
(0008,0090)	PN	2	Referring Physician's Name	
(0020,0010)	SH	2	Study ID	
(0008,1030)	LO	3	Study Description	

6.1.4. Patient Study Module

Tag	VR	Type	Attribute Name	Remarks
(0010,1020)	DS	3	Patient's Size	
(0010,1030)	DS	3	Patient's Weight	

6.1.5. General Series Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0060)	CS	1	Modality	
(0020,000E)	UI	1	Series Instance UID	
(0020,0011)	IS	2	Series Number	
(0020,0060)	CS	2C	Laterality	
(0008,0021)	DA	3	Series Date	
(0008,0031)	TM	3	Series Time	
(0008,103E)	LO	3	Series Description	
(0008,1050)	PN	3	Performing Physician's Name	
(0008,1050)	PN	3	Operator's Name	

6.1.6. General Equipment Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0070)	LO	2	Manufacturer	
(0008,0080)	LO	3	Institution Name	
(0008,0081)	ST	3	Institution Address	
(0008,1010)	SH	3	Station Name	
(0008,1040)	LO	3	Institutional Department Name	
(0018,1020)	LO	3	Software Version(s)	

6.1.7. Contrast/Bolus Module

Tag	VR	Type	Attribute Name	Remarks
(0018,0010)	LO	2	Contrast/Bolus Agent	
(0018,1042)	TM	3	Contrast/Bolus Start Time	

6.1.8. Cine Module

Tag	VR	Type	Attribute Name	Remarks
(0018,1065)	DS	1C	Frame Time Vector	Not available on Reference image.
(0008,2144)	IS	3	Recommended Display Frame Rate	Not available on Reference image.

6.1.9. Multi-Frame Module

Tag	VR	Type	Attribute Name	Remarks
(0028,0008)	IS	1	Number of Frames	Not available on Reference image.
(0028,0009)	AT	1	Frame Increment Pointer	Not available on Reference image.

6.1.10. Frame Pointers Module

Tag	VR	Type	Attribute Name	Remarks
(0028,6010)	US	3	Representative Frame Number	Not available on Reference image.
(0028,6020)	US	3	Frame Numbers of Interest (FOI)	Not available on Reference image.
(0028,6022)	LO	3	Frame(s) of Interest Description	Not available on Reference image.

6.1.11. Mask Module

(This module is available only if the image is DSA.)

Tag	VR	Type	Attribute Name	Remarks
(0028,6100)	SQ	1	Mask Subtraction Sequence	
>(0028,6101)	CS	1	Mask Operation	
>(0028,6110)	US	1C	Mask Frame Numbers	
>(0028,6112)	US	3	Contrast Frame Averaging	
>(0028,6114)	FL	3	Mask Sub-pixel Shift	
>(0028,6190)	ST	3	Mask Operation Explanation	
(0028,1090)	CS	2	Recommended Viewing Mode	

6.1.12. Display Shutter Module

(This module is available only if the image is DSA.)

Tag	VR	Type	Attribute Name	Remarks
(0018,1600)	CS	1	Shutter Shape	
(0018,1602)	IS	1C	Shutter Left Vertical Edge	
(0018,1604)	IS	1C	Shutter Right Vertical Edge	
(0018,1606)	IS	1C	Shutter Upper Horizontal Edge	
(0018,1608)	IS	1C	Shutter Lower Horizontal Edge	
(0018,1622)	US	3	Shutter Presentation Value	

6.1.13. General Image Module

Tag	VR	Type	Attribute Name	Remarks
(0020,0013)	IS	2	Instance Number	
(0008,0023)	DA	2C	Content Date	
(0008,0033)	TM	2C	Content Time	
(0020,0020)	CS	2C	Patient Orientation	
(0008,0022)	DA	3	Acquisition Date	
(0008,0032)	TM	3	Acquisition Time	
(0008,2112)	SQ	3	Source Image Sequence	
(0020,4000)	LT	3	Image Comments	

6.1.14. Image Pixel Module

Tag	VR	Type	Attribute Name	Remarks
(0028,0010)	US	1	Rows	
(0028,0011)	US	1	Columns	
(7FE0,0010)	OW	1	Pixel Data	

6.1.15. X-ray Image Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0008)	CS	1	Image Type	
(0028,0002)	US	1	Samples per Pixel	
(0028,0004)	CS	1	Photometric Interpretation	
(0028,0100)	US	1	Bits Allocated	
(0028,0101)	US	1	Bits Stored	
(0028,0102)	US	1	High Bit	
(0028,0103)	US	1	Pixel Representation	
(0028,1040)	CS	1	Pixel Intensity Relationship	
(0008,1140)	SQ	1C	Referenced Image Sequence	Available on Reference, Bi-plane DA and Bi-plane DSA image.
>(0008,1150)	UI	3	Referenced SOP Class UID	Available on Reference, Bi-plane DA and Bi-plane DSA image.
>(0008,1155)	UI	3	Referenced SOP Instance UID	Available on Reference, Bi-plane DA and Bi-plane DSA image.

6.1.16. Curve Module

Tag	VR	Type	Attribute Name	Remarks
(5000,0005)	US	1	Curve Dimensions	Available when ECG is connected.
(5000,0010)	US	1	Number of Points	Available when ECG is connected.
(5000,0020)	CS	1	Type of Data	Available when ECG is connected.
(5000,0103)	US	1	Data Value Representation	Available when ECG is connected.
(5000,3000)	OW	1	Curve Data	Available when ECG is connected.
(5000,0110)	US	1C	Curve Data Descriptor	Available when ECG is connected.
(5000,0112)	US	1C	Coordinate Start Value	Available when ECG is connected.
(5000,0114)	US	1C	Coordinate Step Value	Available when ECG is connected.
(5000,0022)	LO	3	Curve Description	Available when ECG is connected.
(5000,0030)	SH	3	Axis Units	Available when ECG is connected.
(5000,2500)	LO	3	Curve Label	Available when ECG is connected.

6.1.17. X-Ray Acquisition Module

Tag	VR	Type	Attribute Name	Remarks
(0018,1155)	CS	1	Radiation Setting	
(0018,0060)	DS	2	KVP	
(0018,1150)	IS	2C	Exposure Time	
(0018,1151)	IS	2C	X-Ray Tube Current	
(0018,1147)	CS	3	Field of View Shape	
(0018,1149)	IS	3	Field of View Dimension(s)	
(0018,115A)	CS	3	Radiation Mode	
(0018,115E)	DS	3	Image Area Dose Product	Available when dosimeter is connected, but not available on 3D-DA image.
(0018,1166)	CS	3	Grid	

6.1.18. X-ray Collimator Module

Tag	VR	Type	Attribute Name	Remarks
(0018,1700)	DA	1	Collimator Shape	
(0018,1720)	TM	1C	Vertices of the Polygonal Collimator	

6.1.19. XA Positioner Module

Tag	VR	Type	Attribute Name	Remarks
(0018,1510)	DS	2	Positioner Primary Angle	
(0018,1511)	DS	2	Positioner Secondary Angle	
(0018,1500)	CS	2C	Positioner Motion	
(0018,1520)	DS	2C	Positioner Primary Angle Increment	Available on 3D-DA image.
(0018,1521)	DS	2C	Positioner Secondary Angle Increment	Available on 3D-DA image.
(0018,1110)	DS	3	Distance Source to Detector	
(0018,1111)	DS	3	Distance Source to Patient	
(0018,1114)	DS	3	Estimated Radiographic Magnification Factor	
(0018,1530)	DS	3	Detector Primary Angle	
(0018,1531)	DS	3	Detector Secondary Angle	

6.1.20. SOP Common Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0005)	CS	1C	Specific Character Set	
(0008,0016)	UI	1C	SOP Class UID	
(0008,0018)	UI	1C	SOP Instance UID	
(0008,0012)	DA	3	Instance Creation Date	
(0008,0013)	TM	3	Instance Creation Time	

6.1.21. VOI LUT Module

Tag	VR	Type	Attribute Name	Remarks
(0028,1051)	DS	1C	Window Width	
(0028,1050)	DS	3	Window Center	

6.1.22. Additional Attributes Module

Tag	VR	Type	Attribute Name	Remarks
(0008,1160)	IS	3	Referenced Frame Number	Available on Reference image.

6.2. Secondary Capture Image

6.2.1. Dicom Meta Information

Tag	VR	Type	Attribute Name	Remarks
(0002,0000)	UL	1	Group 0002 Length	
(0002,0001)	OB	1	File Meta Information Version	
(0002,0002)	UI	1	Media Storage SOP Class UID	
(0002,0003)	UI	1	Media Storage SOP Instance UID	
(0002,0010)	UI	1	Transfer Syntax UID	
(0002,0012)	UI	1	Implementation Class UID	
(0002,0013)	SH	3	Implementation Version Name	
(0002,0016)	AE	3	Source Application Entry Title	

6.2.2. Patient Module

Tag	VR	Type	Attribute Name	Remarks
(0010,0010)	PN	2	Patient's Name	
(0010,0020)	LO	2	Patient ID	
(0010,0030)	DA	2	Patient's Birth Date	
(0010,0040)	CS	2	Patient's Sex	

6.2.3. General Study Module

Tag	VR	Type	Attribute Name	Remarks
(0020,000D)	UI	1	Study Instance UID	
(0008,0020)	DA	2	Study Date	
(0008,0030)	TM	2	Study Time	
(0008,0050)	SH	2	Accession Number	
(0008,0090)	PN	2	Referring Physician's Name	
(0020,0010)	SH	2	Study ID	
(0008,1030)	LO	3	Study Description	

6.2.4. Patient Study Module

Tag	VR	Type	Attribute Name	Remarks
(0010,1020)	DS	3	Patient's Size	
(0010,1030)	DS	3	Patient's Weight	

6.2.5. General Series Module

Tag	VR	Type	Attribute Name	Remarks
(0020,000E)	UI	1	Series Instance UID	
(0020,0011)	IS	2	Series Number	
(0020,0060)	CS	2C	Laterality	
(0008,0021)	DA	3	Series Date	
(0008,0031)	TM	3	Series Time	
(0008,103E)	LO	3	Series Description	
(0008,1050)	PN	3	Performing Physician's Name	
(0008,1070)	PN	3	Operators' Name	

6.2.6. General Equipment Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0070)	LO	2	Manufacturer	
(0008,0080)	LO	3	Institution Name	
(0008,0081)	ST	3	Institution Address	
(0008,1010)	SH	3	Station Name	
(0008,1040)	LO	3	Institutional Department Name	
(0018,1020)	LO	3	Software Version(s)	

6.2.7. SC Equipment Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0064)	CS	1	Conversion Type	
(0008,0060)	CS	3	Modality	
(0018,1010)	LO	3	Secondary Capture Device ID	

6.2.8. General Image Module

Tag	VR	Type	Attribute Name	Remarks
(0020,0013)	IS	2	Instance Number	
(0008,0023)	DA	2C	Content Date	
(0008,0033)	TM	2C	Content Time	
(0020,0020)	CS	2C	Patient Orientation	
(0008,0008)	CS	3	Image Type	
(0008,0022)	DA	3	Acquisition Date	
(0008,0032)	TM	3	Acquisition Time	
(0008,2111)	ST	3	Derivation Description	
(0020,4000)	LT	3	Image Comments	
(0008,1140)	SQ	3	Referenced Image Sequence	
>(0008,1150)	UI	3	Referenced SOP Class UID	
>(0008,1155)	UI	3	Referenced SOP Instance UID	

6.2.9. Image Pixel Module

Tag	VR	Type	Attribute Name	Remarks
(0028,0002)	US	1	Samples per Pixel	
(0028,0004)	CS	1	Photometric Interpretation	
(0028,0010)	US	1	Rows	
(0028,0011)	US	1	Columns	
(0028,0100)	US	1	Bits Allocated	
(0028,0101)	US	1	Bits Stored	
(0028,0102)	US	1	High Bit	
(0028,0103)	US	1	Pixel Representation	
(7FE0,0010)	OW	1	Pixel Data	

6.2.10. X-ray Collimator Module

Tag	VR	Type	Attribute Name	Remarks
(0018,1700)	DA	1	Collimator Shape	
(0018,1720)	TM	1C	Vertices of the Polygonal Collimator	

6.2.11. SOP Common Module

Tag	VR	Type	Attribute Name	Remarks
(0008,0005)	CS	1C	Specific Character Set	
(0008,0016)	UI	1C	SOP Class UID	
(0008,0018)	UI	1C	SOP Instance UID	
(0008,0012)	DA	3	Instance Creation Date	
(0008,0013)	TM	3	Instance Creation Time	

6.2.12. VOI LUT Module

Tag	VR	Type	Attribute Name	Remarks
(0028,1051)	DS	1C	Window Width	
(0028,1050)	DS	3	Window Center	

6.2.13. Additional Attributes Module

Tag	VR	Type	Attribute Name	Remarks
(0008,1160)	IS	3	Referenced Frame Number	
(0028,1040)	CS	3	Pixel Intensity Relationship	

6.3. Data Dictionary of Private Attributes

All private attributes are deleted from images by executing the image processing on the gateway system.

Tag	VR	Type	Attribute Name	Remarks
(0029,0015)	LO	1	Private Creator	
(0029, 1501)	DS	1	Tilting Angle	
(0029, 1502)	IS	1	FPD Size	
(0029, 1509)	LO	1	DUP Name	

Use the following tags for 3D-DA images.

Tag	VR	Type	Attribute Name	Remarks
(6B01, 0001)	LO	—	Private Creator	
(6B01, 0100)	LO	—	3D-DSA, 3D-DA, 3D-RSM, (CB Future)	
(6B01, 0101)	CS	—	Sensor Type: 0=I.I, 1=FPD	
(6B01, 0102)	CS	—	08:MH200, 09:MH300, 10:MH200S	
(6B01, 0103)	DS	—	Mask Frames Count/Frames Before Rotation/Total Frames	
(6B01, 0108)	DS	—	Rotation Speed (degrees/sec)	
(6B01, 0180)	OB	—	mAs	
(7FDF, 0010)	LO	—	Header Padding Group	
(7FDF, 1001)	OB	—	Header Padding	