DICOM CONFORMANCE STATEMENT
FOR
TOSHIBA DIGITAL FLUOROGRAPHY SYSTEM

MODEL DFP-2000A

with XIDF-053A or XIDF-056A

(MIIXR0001EAA)

TOSHIBA CORPORATION

C-1

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Table of Contents

1   Introduction

This document is a DICOM Conformance Statement for Toshiba's Digital Fluorography Systems. It is intended to provide the reader with the knowledge of how to integrate this product within a DICOM compliant hospital network. It details the DICOM Service Classes, Information Objects, and Communication Protocols which are supported by this product.

If the reader is unfamiliar with DICOM, it is recommended that they read the DICOM Specification (referenced below) prior to reading this conformance statement. Also note that this document is formatted according to the DICOM Specification, Part 2: Conformance.

1.1   References

- ACR-NEMA Digital Imaging and Communications in Medicine, DICOM V3.0.

1.2   Definitions

- **Association Establishment** - An Association Establishment is the first phase of communication between two DICOM Application Entities. The AEs use the Association Establishment to negotiate how data will be encoded and the type of data to be exchanged.

- **Called Application Entity Title** - The Called AE Title defines the intended receiver of an Association.

- **Calling Application Entity Title** - The Calling AE Title defines the requester of an Association.

- **DICOM Message Service Element (DIMSE)** - A DIMSE defines the services and protocols utilized by an Application Entity to exchange messages.

- **Information Object Definition (IOD)** - An IOD is a data model which is an abstraction of real-world information. This data model defines the nature and attributes relevant to the class of real-world objects represented.

- **Service Class Provider (SCP)** - A Service Class Provider plays the "server" role to perform operations and invoke notifications during an Association. An example of a Storage Service Class Provider would be an image storage device. In this case, the image storage device is storing the image that was sent by a Service Class User.

- **Service Class User (SCU)** - A Service Class User plays the "client" role to invoke operations and perform notifications during an Association. An example of a Storage Service Class User would be an image acquisition device. In this case, the image acquisition device will create and send a DICOM image by requesting that a Service Class Provider store that image.

- **Service/Object Pair (SOP) Class** - A SOP Class is defined by the union of an Information Object Definition and a set of DIMSE Services. A DICOM Application Entity may support one or more SOP Classes. Each SOP Class is uniquely identified by a SOP Class UID.

- **SOP Instance** - A specific occurrence of a Information Object.

- **Transfer Syntax** - The Transfer Syntax is a set of encoding rules that allow DICOM Application Entities to negotiate the encoding techniques (e.g. data element structure, byte ordering, compression) they are able to support. The Transfer Syntax is negotiated during Association Negotiation.

- **Unique Identifier (UID)** - A Unique Identifier is a globally unique, ISO compliant, ASCII-numeric string. It guarantees uniqueness across multiple countries, sites, vendors and equipment.

1.3   Acronyms, Abbreviations and Symbols

- ACC   American College of Cardiology
- ACR   American College of Radiology
- ASCII   American Standard Code for Information Interchange
- AE   Application Entity
- ANSI   American National Standards Institute
- CEN TC251   Comite Europeen de Normalisation - Technical Committee 251 - Medical Informatics
- 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
- HIS   Hospital Information System
- HL7   Health Level 7
- IE   Information Entity
- IOD   Information Object Definition
- ISO   International Standards Organization
- JIRA   Japan Industries Association of Radiological Systems
- NEMA   National Electrical Manufacturers Association
- OSI   Open Systems Interconnection
- PDU   Protocol Data Unit
- RIS   Radiology Information System
- SCP   Service Class Provider
- SCU   Service Class User
- SOP   Service-Object Pair
- TCP/IP   Transmission Control Protocol/Internet Protocol
- UID   Unique Identifier

2 Implementation Model

2.1 Application Data Flow Diagram
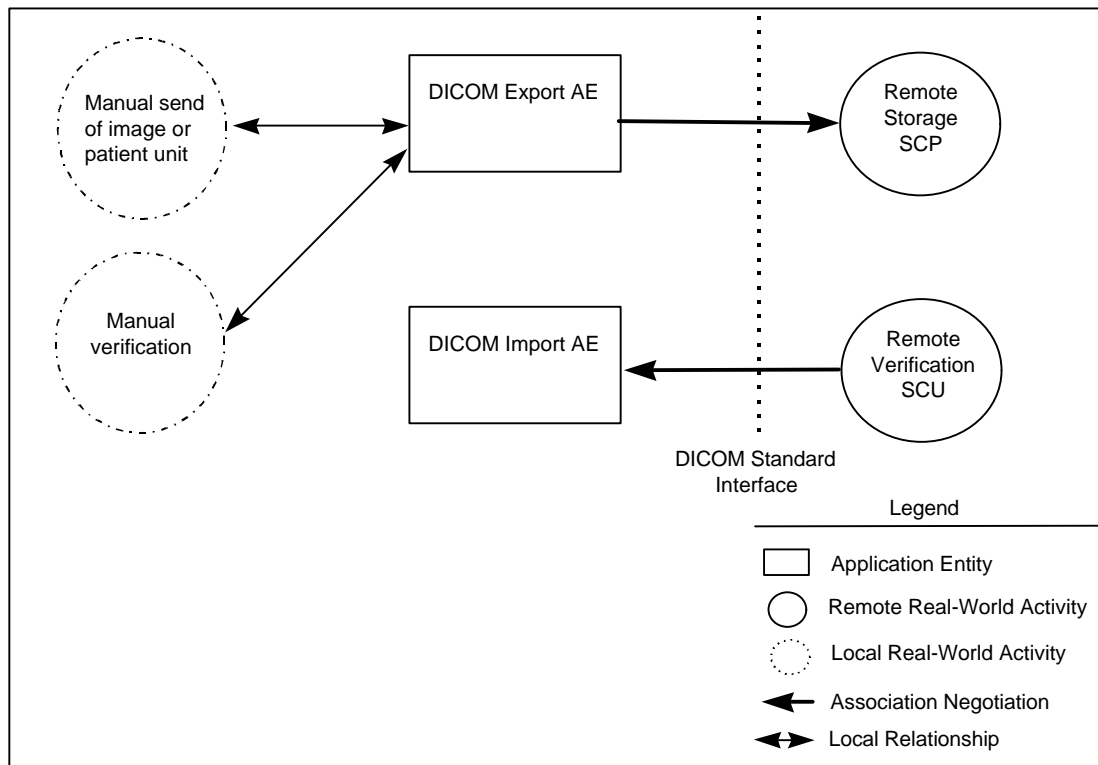
Figure 1

2.2 Functional Definitions of AE's

2.2.1 Export AE

Export AE is used to transmit images to a remote DICOM device. It therefore performs the following tasks:

- Builds DICOM XA Information Objects

- Establishes DICOM Association with remote DICOM device

- Performs storage of DICOM XA Information Objects to remote DICOM device

Export AE is used to verify that a remote DICOM device is active on the network. It therefore performs the following tasks:

- Establishes DICOM Association with remote DICOM device

- Performs verification of a remote DICOM device's presence on network

2.2.2 Import AE

Import AE is used to respond to requests to verify that the Digital Fluorography System is present and active on the network.

2.3 Sequencing of Real World Activities

2.3.1 Features

2.3.1.1 Manual send of image or patient unit

- Operator requests to send images after selecting the transferred images from the Patient List or from the Image List.

- When the image transfer fails, operator can manually attempt to resend the image at a later time.

2.3.1.2 Manual verification

- Operator can request verification manually on troubleshooting.

2.3.2 Operation

2.3.2.1 Manual send of image or patient unit

- The operation for manual image transferring is described below:
  STEP-1:   Select the destination of image transfer.
  STEP-2:   Select the images or the patient to be transferred.
  STEP-3:   Request transfer.

2.3.2.2 Manual verification

- The operation for manual verification is described below:
  STEP-1:   Select the destination of verification.
  STEP-2:   Request verification.

3 AE Specifications

3.1 Export Specification

Export AE provides Standard Conformance to the following DICOM SOP Classes as an SCU:

Table 1

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1

3.1.1 Export Association Establishment Policies

3.1.1.1 Export General

Export AE will utilize and understand the following Application Context Name:

Table 2

DICOM V3.0 Application Context	1.2.840.10008.3.1.1.1

Export AE supports a minimum PDU size of 8Kbytes and a maximum PDU size of 32Kbytes. The default value is set to 16Kbytes.

3.1.1.2 Export Number of Associations

Export AE can only establish one association at a time, independent of the number of destinations chosen.

3.1.1.3 Export Asynchronous Nature

Export AE allows a single outstanding operation on any association. Therefore, Export AE does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

3.1.1.4 Export Implementation Identifying Information

Export AE will specify the following Implementation Identifying Information:

- Implementation Class UID   1.2.392.200036.9116.31
- Implementation Version Name   TM_XA_DCM_V1.0

3.1.2 Export Association Initiation by Real-World Activity

Export AE initiates an association when the following activity is chosen by the operator:

- "Manual send of image or patient unit"
  - Storage   - Create and store an XA image to a remote DICOM device
- "Manual verification"
  - Verification - Verify that a remote DICOM device is present on the network

    Verification is initiated manually.

3.1.2.1 Export Real-World Activity - Storage

3.1.2.1.1 Export Associated Real-World Activity - Storage

Storage is executed by the Digital Fluorography System after the operator requests the image transfer.

3.1.2.1.2 Export Proposed Presentation Contexts - Storage

Export AE proposes the following Presentation Contexts shown below:

For single frame image, "Implicit VR Little Endian" is always used.

For multi frame image, either "Implicit VR Little Endian" or "Lossless JPEG" is used.

Table 3

Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
XA 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
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	*1	1.2.840.10008.1.2.4.70	SCU	None

*1: JPEG Lossless (Process 14 [Selection Value1])

3.1.2.1.2.1 Export SOP Specific Conformance - XA Image Storage

Export AE operation involves the following sequence of steps for each image transfer.

      (1)Association establishment(requester only)

      (2)Data transfer(SCU only)

      (3)Association release(requester only)

Export AE judges that the transfer of one image succeeded when the result of (2) "Data transfer" is "Success" even if the result of (3) "Association release" is "Failure".

X-ray Angiographic Information Object Definition is described in chapter 8.

3.1.2.2 Export Real-World Activity - Verification

3.1.2.2.1 Export Associated Real-World Activity - Verification

Verification is executed by the Digital Fluorography System after the operator selects a destination.

3.1.2.2.2 Export Proposed Presentation Contexts - Verification

Export AE proposes the following Presentation Contexts shown below:

Table 4

Presentation Context Table

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

3.1.3   Export Association Acceptance Policy

Export AE does not accept any associations generated by remote applications.

3.2   Import Specification

Import AE provides Standard Conformance to the following DICOM SOP Classes as an SCP:

Table 5

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1

3.2.1   Import Association Establishment Policies

3.2.1.1   Import General

Import AE will utilize and understand the following Application Context Name:

Table 6

DICOM V3.0 Application Context	1.2.840.10008.3.1.1.1

Import AE supports a minimum PDU size of 8Kbytes and a maximum PDU size of 32Kbytes. The default value is set to 16Kbytes.

3.2.1.2   Import Number of Associations

Import AE supports only one association at a time.

3.2.1.3   Import Asynchronous Nature

Import AE allows a single outstanding operation on any association. Therefore, Import AE does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

3.2.1.4   Import Implementation Identifying Information

Import AE will specify the following Implementation Identifying Information:

- Implementation Class UID   1.2.392.200036.9116.31
- Implementation Version Name   TM_XA_DCM_V1.0

3.2.2   Import Association Initiation by Real-World Activity

Import AE never initiates an association.

3.2.3   Import Association Acceptance Policy

When Import AE receives an association request, it will allow the following activities to be performed during that association:

- Verification   - Allow a remote DICOM device to verify that the Digital Fluorography System is active on the DICOM network.

3.2.3.1   Import Real-World Activity - Verification

3.2.3.1.1   Import Associated Real-World Activity - Verification

The Digital Fluorography System responds to Verification made by a remote Verification SCU.

3.2.3.1.2   Import Presentation Context Table - Verification

Import AE accepts all of the Presentation Contexts shown below:

Table 7

Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**	**Role**	**Negotiation**
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

3.2.3.1.2.1   Import SOP Specific Conformance - Verification

Import AE responds with the following status codes in response to a C-ECHO request.

Table 8

Service Status	Further Meaning	Protocol Codes	Description
Success	Success	0x0000	Operation performed properly

3.2.3.1.3   Import Presentation Context Acceptance Criterion- Verification

Import AE accepts the Presentation Contexts listed in the Presentation Context Table.

3.2.3.1.4   Import Transfer Syntax Selection Policies- Verification

Import AE supports only the Implicit VR Little Endian transfer syntax. It rejects any proposed Presentation Context which does not specify the default Implicit VR Little Endian transfer syntax.

4 Communication Profiles

4.1 Supported Communication Stacks

This product provides DICOM TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 OSI Stack

Not applicable to this product.

4.3 TCP/IP Stack

This product inherits its TCP/IP stack from the computer system upon which it executes.

4.3.1 API

Not applicable to this product.

4.3.2 Physical Media Support

This product is indifferent to the physical medium over which TCP/IP executes; it inherits the medium from the computer system upon which it executes.

4.4 Point-to-Point Stack

Not applicable to this product.

5 Extensions/Specializations/Privatizations

Not applicable to this product.

6　Configuration

For the Digital Fluorography System, the configurations can be set.

Note: Settings and changes are performed by Toshiba Service Personnel at the time of installation of the Digital Fluorography System.

6.1　AE Title/Presentation Address Mapping

Mapping from the AE titles to the presentation address is as follows:

- One port number and one AE title can be described for one host name
- Each AE title is mapped to one port number

6.2　Configurable Parameters

6.2.1　Time-out Value, Retry Count, Retry Interval

The time-out value, retry count, and retry interval in each status are shown below:
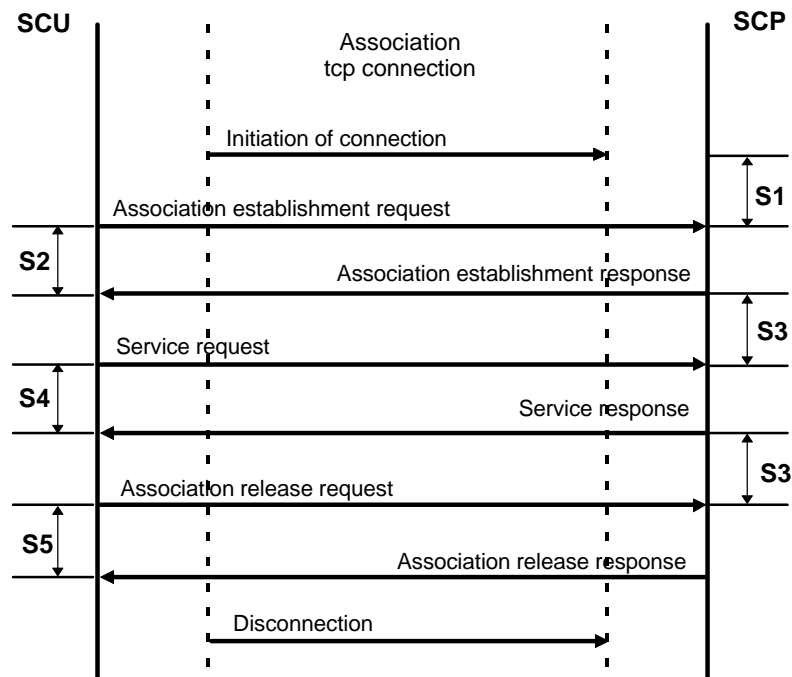
Figure 2

Table 9

Item	Status	Time-out Value	Retry Count	Retry Interval	Remarks
S1	Association establishment request waiting time	default: 30 seconds range: 1 to 999999	Not set	Not set	Only one parameter can be set in the Digital Fluorography System.
S2	Association establishment response waiting time	default: 30 seconds range: 1 to 999999	default : Once range: 0 to 999999	default : 30 seconds range: 0 to 999999	Only one parameter can be set in the Digital Fluorography System.
S3	Service request waiting time	default: 180 seconds range: 1 to 999999	Not set	Not set	Only one parameter can be set in the Digital Fluorography System.
S4	Service response waiting time	default: 180 seconds range: 1 to 999999	Not set	Not set	Can be set for each provided service
S5	Association release waiting time	default: 5 seconds range: 1 to 999999	Not set	Not set	Only one parameter can be set in the Digital Fluorography System.

6.2.2   Warning Status Criteria

The warning status criteria can be set for each station and each service.

6.2.2.1   XA Image Storage Response

If SUCCESS is set, the Digital Fluorography System judges that the image transfer succeeded.

If FAIL is set, the Digital Fluorography System judges that the image transfer failed.

Table 10

Warning Response Item	Default Value	Parameter setting
Coercion of Data Set	FAIL	SUCCESS or FAIL
Data Set does not match SOP Class	FAIL	SUCCESS or FAIL
Element discard	FAIL	SUCCESS or FAIL

6.3   Implementation Information and Maximum Reception PDU Size

The default values for the Digital Fluorography System are used for the Implementation Class UID, the Implementation Version name, and the Maximum length received. They cannot be changed.

Table 11

Parameter	Default
Implementation Class UID	1.2.392.200036.9116.31
Implementation Version Name	TM_XA_DCM_V1.0
Maximum length received(unit:byte)	0x4000

6.4   Default Transfer Syntax

In XA image storage, the Digital Fluorography System performs the transfer using the following setting.

Default value = "Implicit VR Little Endian" for single frame image or uncompressed image

Default value = "Lossless JPEG" for compressed multi-frame image

7 Support of Extended Character Sets

This product supports the following character sets:

Table 12

● ISO-IR 6 (default)	Basic G0 Set

8   X-Ray Angiographic Information Object Definition

8.1   Entity Module Definitions

The information modules for the X-Ray Angiographic devices are defined below.

8.1.1   XA IOD Modules

Table 13

Information Entity	Module	Reference	Usage[1]
Patient	Patient Module	8.2.1	M
Study	General Study Module	8.2.2	M
Study	Patient Study Module	8.2.3	U
Series	General Series Module	8.2.4	M
Equipment	General Equipment Module	8.2.5	M
Image	General Image Module	8.2.6	M
Image	Image Pixel Module	8.2.7	M
Image	Contrast/bolus Module	8.2.8	C
Image	Cine Module	8.2.9	C
Image	Multi-frame Module	8.2.10	C
Image	Frame Pointers Module	Not Used	U
Image	Mask Module	8.2.11	C
Image	Display Shutter Module	Not Used	U
Image	Device Module	Not Used	U
Image	Therapy Module	Not Used	U
Image	X-ray Image Module	8.2.12	M
Image	X-ray Acquisition Module	8.2.13	M
Image	X-ray Collimator Module	Not Used	U
Image	X-ray Table Module	Not Used	C
Image	XA Positioner Module	8.2.14	M
Image	Overlay Plane Module	8.2.15	U
Image	Multi-Frame Overlay Module	Not Used	C
Image	Curve Module	Not Used	U
Image	Modality LUT Module	Not Used	C/U
Image	VOI LUT Module	8.2.16	U
Image	SOP Common Module	8.2.17	M

[1] M=Mandatory, C=Conditional, U=User option

8.2   Information Object Definitions

8.2.1   Patient Module

Table 14

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010, 0010)	2	Always set except for urgent patient
Patient ID	(0010, 0020)	2	Always set
Patient's Birth Date	(0010, 0030)	2	Not set when no entry is made
Patient's Sex	(0010, 0040)	2	Always set
Patient's Comments	(0010, 4000)	3	Not set when no entry is made

8.2.2   General Study Module

Table 15

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020, 000D)	1	Always set
Study Date	(0008, 0020)	2	Always set
Study Time	(0008, 0030)	2	Always set
Referring Physician's Name	(0008, 0090)	2	Always set, Length=0
Study ID	(0020, 0010)	2	Always set, Length=0
Accession Number	(0008, 0050)	2	Always set, Length=0
Study Description	(0008, 1030)	3	Not set when no entry is made

8.2.3   Patient Study Module

Table 16

Attribute Name	Tag	Type	Attribute Description
Patient's Size	(0010, 1020)	3	Not set when no entry is made
Patient's Weight	(0010, 1030)	3	Not set when no entry is made

8.2.4 General Series Module

Table 17

Attribute Name	Tag	Type	Attribute Description
Modality	(0008, 0060)	1	Always set ("XA")
Series Instance UID	(0020, 000E)	1	Always set
Series Number	(0020, 0011)	2	Always set
Series Date	(0008, 0021)	3	Always set
Series Time	(0008, 0031)	3	Always set
Series Description	(0008,103E)	3	Always set
Performing Physician's Name	(0008, 1050)	3	Not set when no entry is made

8.2.5 General Equipment Module

Table 18

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008, 0070)	2	Always set("TOSHIBA_MEC")
Institution Name	(0008, 0080)	3	Always set
Institution Address	(0008,0081)	3	Always set
Station Name	(0008, 1010)	3	Always set
Manufacturer's Model Name	(0008, 1090)	3	Always set
Device Serial Number	(0018, 1000)	3	Always set
Software Versions	(0018, 1020)	3	Always set

8.2.6 General Image Module

Table 19

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020, 0013)	2	Always set
Patient Orientation	(0020, 0020)	2C	Always set, Length=0
Image Date	(0008, 0023)	2C	Always set
Image Time	(0008, 0033)	2C	Always set
Image Type	(0008, 0008)	3	Always set
Acquisition Date	(0008, 0022)	3	Always set
Acquisition Time	(0008, 0032)	3	Always set
Image Comments	(0020, 4000)	3	Not set when no entry is made

8.2.7 Image Pixel Module

Table 20

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028, 0002)	1	Always set(0x0001)
Photometric Interpretation	(0028, 0004)	1	Always set("MONOCHROME2")
Rows	(0028, 0010)	1	Always set(0x0400 or 0x0200)
Columns	(0028, 0011)	1	Always set(0x0400 or 0x0200)
Bits Allocated	(0028, 0100)	1	Always set(0x0010 or 0x0008)
Bits Stored	(0028, 0101)	1	Always set(0x000C or 0x0008)
High Bit	(0028, 0102)	1	Always set(0x000B or 0x0007)
Pixel Representation	(0028, 0103)	1	Always set(0x0000)
Pixel Data	(7FE0, 0010)	1	Always set

8.2.8 Contrast/Bolus Module

Table 21

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018, 0010)	2	Not set when no entry is made
Contrast/Bolus Route	(0018, 1040)	3	Not set when no entry is made
Contrast/Bolus Volume	(0018, 1041)	3	Not set when no entry is made
Contrast Flow Rate(s)	(0018, 1046)	3	Not set when no entry is made

8.2.9 Cine Module

Table 22

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018, 1063)	1C	Always set

8.2.10 Multi-frame Module

Table 23

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028, 0008)	1	Always set
Frame Increment Pointer	(0028, 0009)	1	Always set(0x00181063)

8.2.11 Mask Module

Table 24

Attribute Name	Tag	Type	Attribute Description
Recommended Viewing Mode	(0028, 1090)	2	Always set, Length=0

8.2.12 X-ray Image Module

Table 25

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028, 0009)	1C	Always set(0x00181063)
Image Type	(0008, 0008)	1	Always set
Pixel Intensity Relationship	(0028, 1040)	1	Always set("DISP" or "LIN ")
Samples per Pixel	(0028, 0002)	1	Always set(0x0001)
Photometric Interpretation	(0028, 0004)	1	Always set("MONOCHROME2")
Bits Allocated	(0028, 0100)	1	Always set(0x0010 or 0x0008)
Bits Stored	(0028, 0101)	1	Always set(0x000C or 0x0008)
High Bit	(0028, 0102)	1	Always set(0x000B or 0x0007)
Pixel Representation	(0028, 0103)	1	Always set(0x0000)

8.2.13 X-ray Acquisition Module

Table 26

Attribute Name	Tag	Type	Attribute Description
KVP	(0018, 0060)	2	Always set [kV]
Radiation Setting	(0018, 1155)	1	Always set
X-ray Tube Current	(0018, 1151)	2C	Always set [mA]
Exposure Time	(0018, 1150)	2C	Always set [msec]
Average Pulse Width	(0018, 1154)	3	Always set [msec]
Intensifier Size	(0018, 1162)	3	Always set [mm]
Imager Pixel Spacing	(0018,1164)	3	Always set [mm]

8.2.14 XA Positioner Module

Table 27

Attribute Name	Tag	Type	Attribute Description
Distance Source to Detector	(0018, 1110)	3	Always set [mm]
Estimated Radiographic Magnification Factor	(0018, 1114)	3	Always set
Positioner Motion	(0018, 1500)	2C	Always set("STATIC")
Positioner Primary Angle	(0018, 1510)	2	Always set [degree]
Positioner Secondary Angle	(0018, 1511)	2	Always set [degree]

8.2.15 Overlay Plane Module

This module is set for single frame image only.

Table 28

Attribute Name	Tag	Type	Attribute Description
Rows	(60xx, 0010)	1	Always set
Columns	(60xx, 0011)	1	Always set
Overlay Type	(60xx, 0040)	1	Always set("G")
Origin	(60xx, 0050)	1	Always set
Bits Allocated	(60xx, 0100)	1	Always set(0x0001)
Bit Position	(60xx, 0102)	1	Always set(0x0000)
Overlay Data	(60xx, 3000)	1C	Always set

8.2.16 VOI LUT Module

Table 29

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028, 1050)	3	Always set
Window Width	(0028, 1051)	1C	Always set

8.2.17 SOP Common Module

Table 30

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008, 0016)	1	Always set
SOP Instance UID	(0008, 0018)	1	Always set

E