Philips Medical Systems
DICOM Conformance Statement

Inturis On-line
Release 1.2

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PHILIPS

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1 Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Philips Medical Systems. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X-1996 standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices.
This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM]. The conformance to the DICOM standard is a key element of the Inturis Program (see [INTURIS]).

1.2 Intended audience

This Conformance Statement is intended for:
- (potential) customers,
- system integrators of medical equipment,
- marketing staff interested in system functionality,
- software designers implementing DICOM interfaces.

It is assumed that the reader is familiar with the DICOM standard.

1.3 Contents and structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2-1996.

1.4 Used definitions, terms and abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3-1996 and PS 3.4-1996.
The word Philips in this document refers to Philips Medical Systems.

1.5 References

[DICOM] The Digital Imaging and Communications in Medicine (DICOM) standard:
NEMA PS 3.X 1996
National Electrical Manufacturers Association (NEMA) Publication Sales
1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

[INTURIS] Inturis for Cardiology
On-Line Image Access
Doc. no. 4522 982 69681
Philips Medical Systems Ned. B.V.

1.6 Important note to the reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

- **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 DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.
  It is the user's responsibility to analyse thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

- **Validation**
  Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.
  Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**
  The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.
  The user should ensure that any non-Philips provider linking to Philips equipment, also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7 General Acronyms and Abbreviations.

The following acronyms and abbreviations are used in the document.

- ACC American College of Cardiology
- AE Application Entity
- ACR American College of Radiology
- ANSI American National Standard Institute
- BOT Basic Offset Table
- CD-R CD Recordable
- CD-M CD Medical
- DCI Digital Cardio Imaging
- DCR Dynamic Cardio Review
- DICOM Digital Imaging and Communication in Medicine
- DIMSE DICOM Message Service Element
- DIMSE-C DICOM Message Service Element-Composite
- DIMSE-N DICOM Message Service Element-Normalized
- ELE Explicit VR Little Endian
- FSC File Set Creator
- GUI Graphic User Interface
- HIS Hospital Information System
- HL7 Health Level Seven
- ILE Implicit VR Little Endian
- IOD Information Object Definition
- ISIS Information System - Imaging System
- NEMA National Electrical Manufacturers Association
- PDU Protocol Data Unit
- RIS Radiology Information System
- RWA Real World Activity
- SC Secondary Capture
- SCM Study Component Management
- SCP Service Class Provider
- SCU Service Class User
- SOP Service Object Pair
- TCP/IP Transmission Control Protocol/Internet protocol
- UID Unique Identifier
- WLM Worklist Management

2 Implementation model

The Implementation Model identifies all of the DICOM *Application Entities (AEs)* and relates these Application Entities to the *Real World Activities (RWAs)*.

The DICOM interface for the CD-Medical product range of Philips Medical Systems is a CD Medical implementation of the 120mm *Compact Disc Recordable (CD-R)* medium, as described in the NEMA standard PS3.12-Annex F.
The CD-Medical Transfer Station consists of a CD-Medical Recorder connected to a Diagnostic workstation see Figure 2-2
This Conformance Statement describes the DICOM behaviour of the CD-Medical Transfer Station connected to the On-line Image Server.

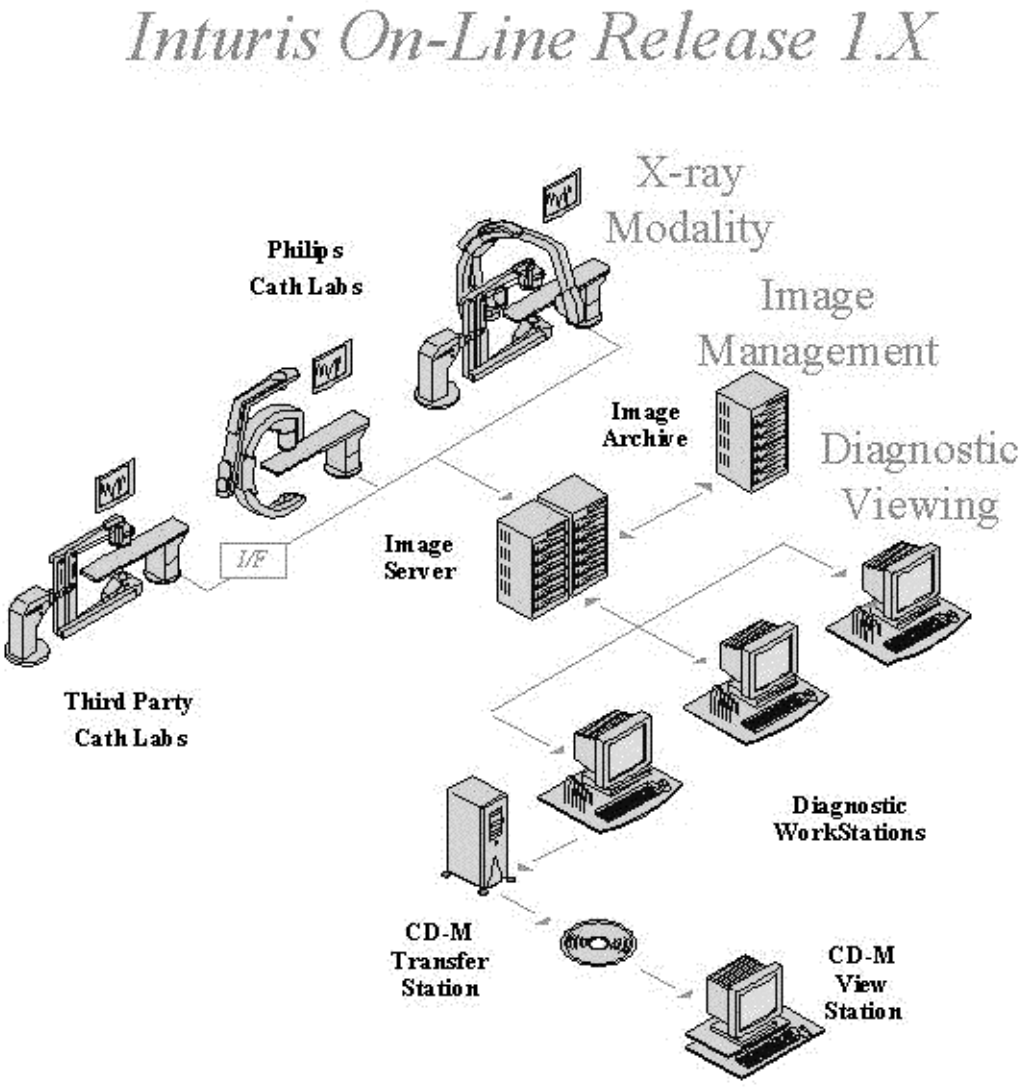

Figure 2-1: Overview of the Inturis On-Line system

2.1 Application Data Flow Diagram

The CD-Medical Recorder application domain can be represented by a single Application Entity, describing the Recording process (see Figure 2-2).
The CD-Medical DICOM Recording process writes the images in two types of data-streams onto the CD-R media. The first stream type is according to the DICOM format of the ACC-ACR-NEMA; i.e. each (cardiac) frame is stored as a 512 x 512, 8 bit wide, pixel matrix using the JPEG **lossless** compression algorithm; i.e. with a compression factor of about 2.
The second stream type stores these images in a **lossy** format, using a JPEG compression factor of about 7. This allows images to be retrieved directly from the CD-R drive for instantaneous dynamic review on the CD-Medical View Station (CDM 3500). It is called the *Dynamic Cardio Review (DCR*). It is an extension to the DICOM Media standard and has been submitted to the ACC-ACR-NEMA committee for inclusion into the standard.

Following the guidelines as proposed in the DCR extension, it is recommended to apply an Edge Enhancement process on the images when reviewing the images from the CD-R medium (see: Section Edge Enhancement Augmentation).
The Pixel Data within the lossless and lossy compressed Image IODs contains a *Basic Offset Table (BOT)* consisting of offsets to each frame within the Data Elements as described in PS 3.5.
The CD-R conforms to the Basic Cardio XA Application Profile for reading purposes (NEMA Standard PS 3.11 Annex A)

Figure 2-2: CD-Medical Recorder Application Dataflow diagram

The Philips modalities mentioned in Figure 2-2 on page 5 are:

DCI CD3300 R 1.1	Conformance Statement	4522 982 65491
DCI CD 3300 R 1.1.6	Conformance Statement	4522 982 71011
Integris CDMedical H R 1.1.1	Conformance Statement	4522 982 61571
Integris CDMedical H R 1.1.6	Conformance Statement	4522 982 71021

2.2 Functional definition of Application Entities

Referring to Figure 2-2, the local RWA “Transfer via Philips Modalities” will cause the AE “DICOM Recording” to initiate the creation of a File-set on the CD-R medium. The term *File-set Creator (FSC)* means that the Recorder device will generate a specific directory structure, the DICOMDIR file, and one or more DICOM files, covering all X-ray images, patient data, study parameters, etc.

2.2.1 Application Entity: DICOM Recording

The AE “DICOM Recording” supports the following functions:

- Initialization of the CD-R Media, writing a DICOM File-set onto the media.
- Copying of *SOP (Service Object Pair)* instances from the local (buffer) storage to the CD-R device.
- Creation of a DICOMDIR file that represents the contents of the (image) data as recorded.

2.3 Sequencing of Real World Activities

The initiation is activated at the Diagnostic Workstation. In case the size of the X-ray Examination exceeds the capacity of a single CD-R medium, the user is prompted to insert a subsequent (blank) CD-R. All recorded discs are self-contained; i.e. each disc has a DICOMDIR file which reflects the contents of that particular CD-R.

2.4 Implementation Identifying Information

The Implementation Identifying Information is available in the File Meta Information part of a DICOM file. The relevant attributes for this Conformance statement are:

Implementation Class UID = “1.3.46.670589.7.1.1.2”
Implementation Version Name = “1_1Y” where Y identifies the software level.

3 AE Specifications

This chapter describes in more detail the DICOM context of each Application Entity.
Since the CD-Medical Transfer Station encompasses a single Application Entity, only one section is necessary to describe the AE specification.

3.1 AE Specification: DICOM Recording

The “DICOM Recording” AE provides Standard Conformance to the DICOM CD Medical Service and File Format Class (PS 3.10) and the Media Storage Application Profile (PS 3.11) as far as the recording of lossless compressed images is concerned.
Moreover it also provides Augmented Conformance to the same DICOM standard in order to support the Dynamic Cardio Review (DCR) capabilities of the CD-Medical Recorder.
The relevant Application Profiles, their Roles and the *Service Class (SC)* options, all defined in DICOM terminology, are listed in Table 3-1.

Table 3-1 : Application Profile, Activities and Roles of the CD-Medical Recorder

Application Profile	*Identifier*	*Real World Activity*	*Role*	*SC Option*
Basic Cardiac X-ray Angiographic Studies on CD-R Media	STD-XABC-CD	Transfer of X-ray Examination	FSC	Interchange
Basic Cardiac Dynamic Review of X-ray Angiographic Studies on CD-R Media	AUG-XABC-DYNAMIC-CD	Transfer of X-ray Examination	FSC	Interchange

3.1.1 Application Entity Title

The Application Entity title is registered into the DICOM File Meta Information header and is supported by the CD-Medical Recorder acting as a FSC.

Source Application Entity Title = “CD-MEDICAL RCST”

3.1.2 RWA Transfer (of X-ray Examination via Philips Modalities)

The “DICOM Recording” AE will act as a FSC using the Interchange option when requested to initialize the media. The SOP instances as provided by the RWA are written to the CD-R media and a corresponding DICOMDIR is created. It is the responsibility of this AE to split up the file-set over two (or more) discs in case the examination cannot be stored on a single CD-R medium.

3.1.3 Application Profile(s) for this RWA

Refer to Table 3-1 for the list of Application Profiles that invoke this AE.

3.1.4 DICOMDIR keys.

In the DICOMDIR file a Basic Directory IOD is present, containing Directory records at the patient, study (-component), series, visit and image level.

4 Augmented Application Profile

The CD-Medical Transfer Station has Augmented Conformance to the Basic Cardiac Application Profile (**STD-XABC-CD**) as mentioned in the previous chapter. This Augmented Application Profile is identified through **AUG-XABC-DYNAMIC-CD** and adds components which facilitate dynamic review of the basic cardiac images stored on the interchange media. The clinical context is further described in [DCR].
Due to this augmentation, the Recorder will identify the private attributes with Private Creator string "**CARDIO-D.R. 1.0**".

4.1 SOP Class Augmentations

The AUG-XABC-DYNAMIC-CD Augmented Application Profile utilizes all of the SOP classes and transfer syntaxes as applicable for the STD-XABC-CD Application profile plus the SOP class and transfer syntax for the lossy compressed Image IOD - see Table AUG-XABC-DYNAMIC-CD SOP Classes and Transfer Syntaxes.
These SOP instances referred to as lossy compressed Image IOD are derived from the lossless compressed images and are encoded with the JPEG lossy compressed transfer syntax as specified in PS-3.5.

Table 4-1 : AUG-XABC-DYNAMIC-CD SOP Classes and Transfer Syntaxes

SOP Class Name	*SOP Class UID*	*Transfer Syntax Definition*	*Transfer Syntax UID*
Media Storage Directory Storage	1.2.840.10008.1.3.10	ELE	1.2.840.10008.1.2.1
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	**JPEG Baseline (Process 1); Lossy JPEG 8 bit image compression** ELE	1.2.840.10008.1.2.4.50
Detached Patient Mgt. Storage	1.2.840.10008.3.1.2.1.1	ELE	1.2.840.10008.1.2.1
Detached Visit Mgt. Storage	1.2.840.10008.3.1.2.2.1	ELE	1.2.840.10008.1.2.1
Detached Study Mgt. Storage	1.2.840.10008.3.1.2.3.1	ELE	1.2.840.10008.1.2.1
Detached Study Component Mgt. Storage	1.2.840.10008.3.1.2.3.2	ELE	1.2.840.10008.1.2.1

4.2 Directory Augmentations

The AUG-XABC-DYNAMIC-CD Augmented Application Profile utilizes the same requirements for Directory Information in the DICOMDIR as the STD-XABC-CD Application Profile with the addition that lossy compressed Image IODs shall be referenced by Image and Private Directory Records.
All Image and Private Directory Records contain, in addition to the keys required by the STD-

XABC-CD Application Profile, the keys specified in Table 4-2.

Table 4-2 : Augmented DICOMDIR keys for AUG-XABC-DYNAMIC-CD

Key Attribute	*Tag*	*Directory Record Type*	*Type*	*Notes*
File Location	(0009,xx00)	IMAGE + PRIVATE	3	Start location of file specified by Ref. File ID. (0004,1500). Specified as a number of bytes from the beginning of the medium.
File Size	(0009,xx01)	IMAGE + PRIVATE	1C	Size of file specified by Ref. File ID. (0004,1500). Specified as a number of bytes. Required if File Location is present.
Alternate Image Sequence	(0009,xx40)	IMAGE	3	Identifies the derived lossy compressed image.
Source Image Sequence	(0008,2112)	PRIVATE	1C	Identifies the original lossless compressed image.
Image Sequence Number	(0021,xx13)	IMAGE + PRIVATE	2	The sequence number of this image in the Study, as stored on the medium.

The Private Record UID = “1.3.46.670589.7.1.1.3”

4.3 Edge Enhancement Augmentation

Each frame within an lossy compressed XA image will be Edge Enhanced by applying the formula and the values specified in Table 4-3. Each lossless compressed XA image will contain the Edge Enhancement Attributes as specified in Table 4-3. The reader of the CD-R media is able to edge enhance these lossless compressed images according to the specified formula.

Table 4-3 : Edge Enhancement Augmentation

Attribute Name	*Tag*	*Type*	*Attribute Description*
Edge Enhancement Sequence	(0029,xx00)	3	Edge Enhancement Sequence describing the Edge Enhancement Filter to be applied to the image. *Formula: E=F+((F-C)*G)* *E: Pixel value of enhanced frame* *F: pixel value of source frame* *C: pixel value of convoluted region* *G: edge enhancement gain*

Table 4-3 : Edge Enhancement Augmentation (Continued)

> Convolution Kernel Size	(0029,xx01)	1C	Number of rows and columns in the convolution kernel. The first value specifies the number of rows; the second value specifies the number of columns. Values shall be equal or greater than 3. Required if Edge Enhancement. Sequence (0029,xx00) is present.
> Convolution Kernel Coefficients	(0029,xx02)	1C	The coefficients of the convolution kernel organized by row from left to right starting with the top row. The number of values shall be equal to the number of rows times the number of columns specified in the Convolution Kernel Size. Required if Edge Enhancement Sequence (0029,xx00) is present.
> Edge Enhancement Gain	(0029,xx03)	1C	Edge Enhancement Gain to be used. Required if Edge Enhancement Sequence (0029,xx00) is present.

4.4 Other Augmentations

Table 4-4 specifies additional augmentations in the lossless and lossy compressed XA Image IOD

Table 4-4 : Augmented Attributes for the lossless and lossy compressed XA Image IOD

Key Attribute	*Tag*	*Module*	*Type*	*Notes*
Alternate Image Sequence	(0009,xx40)	General Image	3	Identifies the derived lossy compressed image. This Attribute is only present in lossless compressed images.
Source Image Sequence	(0008,2112)	General Image	3	Identifies the original lossless compressed image. This Attribute is only present in lossy compressed images.
Maximum Image Frame Size	(0019,xx30)	Cine	3	Maximum size of any compressed frame in the image, in bytes.

5 Extensions/Specializations/Privatization

In this chapter additional extensions to the DICOM definition are described. These extensions are applicable to both the lossless and the lossy compressed Image IODs, unless stated otherwise.
Due to these extensions, the CD-Recorder will recognise private attributes identified with Private Creator string "**CARDIO-D.R. 1.0**".

5.1 ECG Data

ECG Data is optional within the lossless and lossy compressed Image IOD definitions. If included the ECG data shall be defined as a two dimensional curve using Data Elements (5000,XXXX).
The ECG Data definition is according to the Curve Module definition (Section C.10.2 in PS 3.3):

Table 5-1 : Curve Module

Attribute Name	*Tag*	*Type*	*Attribute Description*
Curve Dimensions	(5000,0005)	1	Fixed value: 2
Number of Points	(5000,0010)	1	
Type of Data	(5000,0020)	1	ECG
Axis Units	(5000,0030)	1	Defines that the 'X' axis is in units of Data Points per Second (DPPS) and that the 'Y' axis has no units (NONE)
Data Value Representation	(5000,0103)	1	Fixed to 0000H (unsigned short)
Curve Data Descriptor	(5000,0110)	1	Specifies that the 'X' axis is defined using Interval Spacing (0000H) and that the 'Y' axis is defined by value (0001H).
Coordinate Start Value	(5000,0112)	1	Fixed to 0000H
Coordinate Step Value	(5000,0114)	1	
Curve Data	(5000,3000)	1	ECG data

5.2 Image Blanking

A (private) Image Blanking module is (optionally) present to support Image Blanking phenomena (e.g. blanking circle) at the View Station receptor side. This module is structured according to the Display Shutters module in the DICOM standard (see PS 3.3 and Table Edge

Enhancement Augmentation).

Table 5-2 : Image Blanking Module

Attribute Name	*Tag*	*Type*	*Attribute Description*
Image Blanking Shape	(0019,xx00)	3	Shape(s) of the image blanking defined for display Enumerated values: RECTANGULAR CIRCULAR This multi-valued attribute shall contain at most one of each Enumerated value.
Image Blanking Left Vertical Edge	(0019,xx02)	1C	Location of the left edge of the rectangular image blanking with respect to pixels in the image given as column. Required if Image Blanking Shape (0019,xx00) is RECTANGULAR.
Image Blanking Right Vertical Edge	(0019,xx04)	1C	Location of the right edge of the rectangular image blanking with respect to pixels in the image given as column. Required if Image Blanking Shape (0019,xx00) is RECTANGULAR.
Image Blanking Upper Horizontal Edge	(0019,xx06)	1C	Location of the upper edge of the rectangular image blanking with respect to pixels in the image given as row. Required if Image Blanking Shape (0019,xx00) is RECTANGULAR.
Image Blanking Lower Horizontal Edge	(0019,xx08)	1C	Location of the lower edge of the rectangular image blanking with respect to pixels in the image given as row. Required if Image Blanking Shape (0019,xx00) is CIRCULAR.
Center of Circular Image Blanking	(0019,xx10)	1C	Radius of the circular image blanking with respect to pixels in the image given as row and column. Required if Image Blanking Shape (0019,xx00) is CIRCULAR.
Radius of Circular Image Blanking	(0019,xx12)	1C	Location of the center of the circular image blanking with respect to pixels in the image given as number of pixels. Required if Image Blanking Shape (0019,xx00) is CIRCULAR.

5.3 Other Extensions

Table 5-3 summarize individual attribute extensions for both lossless and lossy compressed XA images.

Table 5-3 : Additional Attributes for STD-XABC-CD and AUG-XABC-DYNAMIC-CD

Key Attribute	*Tag*	*Module*	*Type*	*Notes*
Image Sequence Number	(0021,xx13)	General Image	3	The (sequence) number of the particular image (pair) in the Study. The first image (pair) in a Study has the sequence number 1.
Image Type	(0008,0008)	X-ray Image	1	Image type extended with a fourth value: SINGLE A / SINGLE B acquisition plane parameter S*INGLE A: Image is a single plane acquisition in the first plane (e.g. frontal) of a dual-plane or bi-plane system.* *SINGLE B: Image is a single plane acquisition in the second plane (e.g. lateral) of a dual-plane or bi-plane system.*

6 Configuration

7 Support of Extended Character Sets

The CD-Medical Recorder supports the following Extended Character Set(s):

ISO_IR 100: Latin Alphabet No. 1

8 Specification of the applied IODs

The modules selected from the IOD module table of DICOM 3.0 are given for each applied SOP Class in the tables below. The applied optional standard Attributes are also specified for each module (the applied private Attributes are specified in chapter 5). The references are made to sections of DICOM Part PS 3.3 and its Supplements and (in case of Media Storage Directory information) DICOM Supplement 11 (Media Storage Application Profiles).

Table 8-1 : Applied Modules and optional Attributes in the Media Storage Directory IOD

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Keys*
Media	File-set Identification	B.X.3.2.1	Always	-
	Directory Information	B.X.3.2.2	Always	File Location, File Size
	PATIENT keys	B.X.5.1 A.3.3.1	Always	-
	STUDY keys	B.X.5.2	Always	-
	SERIES keys	B.X.5.3 A.3.3.1	Always	-
	IMAGE keys	B.X.5.4 A.3.3.1	Always	Alternate Image Sequence, Image Sequence Number
	VISIT keys	B.X.5.10	If visit info is present	-
	STUDY COMPONENT keys	B.X.5.13	If study info is present	-
	PRIVATE keys	B.X.6.1	Always	(All keys are specified here) Specific Character Set, Image Type, Referenced Image Sequence, Source Image Sequence, Image Number, Image Sequence Number

Table 8-2 : Applied Modules and optional Attributes in the lossless compressed XA Image IOD

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Attributes*
Patient	Patient	C.7.1.1	Always	Referenced Patient Sequence
Study	General Study	C.7.2.1	Always	Study Description, Referenced Study Sequence
Series	General Series	C.7.3.1	Always	Series Date, Series Time, Performing Physician's Name, Referenced Study Component Sequence
Equipment	General Equipment	C.7.5.1	Always	Institution Name, Institution Address, Manufacturer's Model Name, Software Version(s)
Image	General Image (extended)	C.7.6.1	Always	Acquisition Date, Acquisition Time, Acquisition Number, Alternate Image Sequence, Images in Acquisition, Image Comments, Image Sequence Number
	Image Pixel	C.7.6.3	Always	-
	Cine (extended)	C.7.6.5	If multi-frame cine data	Frame Delay, Maximum Image Frame Size
	Multi-Frame	C.7.6.6	If multi-frame cine data	-
	Frame Pointers	C.7.6.9	Always	Representative Frame Number
	Display Shutters	C.7.6.11	If shutter(s) applied	-
	Image Blanking (private)	C.7.6.11	If blanking applied	-
	X-Ray Image (extended)	C.8.7.1	Always	Scan Options, Calibration Object
	X-Ray Acquisition	C.8.7.2	Always	-
	XA Positioner	C.8.7.5	Always	-
	Curve	C.10.2	If curve data is present	Axis Units
	VOI LUT	C.11.2	If window info. present	Window Center
	SOP Common	C.12.1	Always	Instance Creation Date, Instance Creation Time, Instance Creator UID

Table 8-3 : Applied Modules and optional Attributes in the lossy compressed XA Image IOD

IE	*Applied Module*	*Reference*	*Presence*	*Applied optional Attributes*
Patient	Patient	C.7.1.1	Always	Referenced Patient Sequence
Study	General Study	C.7.2.1	Always	Study Description, Referenced Study Sequence
Series	General Series	C.7.3.1	Always	Series Date, Series Time, Performing Physician's Name, Referenced Study Component Sequence
Equipment	General Equipment	C.7.5.1	Always	Institution Name, Institution Address, Manufacturer's Model Name, Software Version(s)
Image	General Image (extended)	C.7.6.1	Always	Acquisition Date, Acquisition Time, Source Image Sequence, Acquisition Number, Images in Acquisition, Image Comments, Image Sequence Number
	Image Pixel	C.7.6.3	Always	-
	Cine (extended)	C.7.6.5	If multi-frame cine data	Frame Delay, Maximum Image Frame Size
	Multi-Frame	C.7.6.6	If multi-frame cine data	-
	Frame Pointers	C.7.6.9	Always	Representative Frame Number
	Display Shutters	C.7.6.11	If shutter(s) applied	-
	Image Blanking (private)	C.7.6.11	If blanking applied	-
	X-Ray Image (extended)	C.8.7.1	Always	Derivation Description, Scan Options, Calibration Object
	X-Ray Acquisition	C.8.7.2	Always	-
	XA Positioner	C.8.7.5	Always	-
	Curve	C.10.2	If curve data is present	Axis Units
	VOI LUT	C.11.2	If window info. present	Window Center
	SOP Common	C.12.1	Always	Instance Creation Date, Instance Creation Time, Instance Creator UID

Table 8-4 : Applied Modules and optional Attributes in the Detached Patient IOD (see N-GET Typing)

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Attributes*
Patient	Patient Relationship	C.2.1	Always	-
	Patient Identification	C.2.2	Always	-
	Patient Demographic	C.2.3	Always	-
	SOP Common	C.12.1	Always	SOP Class UID, SOP Instance UID, Instance Creation Date, Instance Creation Time, Instance Creator UID

Table 8-5 : Applied Modules and optional Attributes in the Detached Study IOD (see N-GET Typing)

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Attributes*
Study	Study Relationship	C.4.1	Always	Study Instance UID
	Study Identification	C.4.2	Always	-
	Study Acquisition	C.4.5	Always	Acquisitions in Study, Study Date, Study Time, Series in Study
	SOP Common	C.12.1	Always	SOP Class UID, SOP Instance UID, Instance Creation Date, Instance Creation Time, Instance Creator UID

Table 8-6 : Applied Modules and optional Attributes in the Detached Visit IOD (see N-GET Typing)

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Attributes*
Visit	Visit Relationship	C.3.1	Always	-
	Visit Identification	C.3.2	Always	Institution Name, Admission ID
	Visit Admission	C.3.4	Always	Admitting Date
	SOP Common	C.12.1	Always	SOP Class UID, SOP Instance UID, Instance Creation Date, Instance Creation Time, Instance Creator UID

Table 8-7 : Applied Modules and optional Attributes in Det. Study Component IOD (see N-GET Typing)

IE	*Applied Modules*	*Reference*	*Presence*	*Applied optional Attributes*
Study Component	Study Component Relationship	C.4.8	Always	-
	Study Component Acquisition	C.4.9	Always	Performing Physician’s Name
	Study Component (extended)	C.4.7	Always	Alternate Image Sequence (nested in Referenced Series Sequence), Study Instance UID,
	SOP Common	C.12.1	Always	SOP Class UID, SOP Instance UID, Instance Creation Date, Instance Creation Time, Instance Creator UID

9 Known Problems.

- Sometimes, more than one CD is necessary for storing the acquired data for one examination. In exceptional circumstances, the first image file on the second CD refers to the study on the first CD-ROM.