Philips Medical Systems
DICOM Conformance Statement

CT Tomoscan M/EG

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**Philips
Medical
Systems**

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-1993 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. 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 3.2-1993 and Supplement 2 (in case of Media specifications).
Additionally, the chapters following 7 specify the details of the applied IODs.

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 3.3-1993 and PS 3.4-1994.
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 (X refers to the part 1 - 13) and Supplements
            National Electrical Manufacturers Association (NEMA) Publication Sales
            1300 N. 17th Street, Suite 1847
            Rosslyn, Va. 22209, United States of America

[INTURIS]   Philips Inturis Program
            Integrated Clinical Solutions
            Philips Medical Systems Nederland B.V. (see address at page ii)

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 fol-
lowing 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 State-
  ment 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 network-
  ing) and incompatibility (in case of media).

2 Implementation model

The CT Tomoscan M/EG (short CT-Tomoscan) system of Philips Medical Systems is a Computed Tomography (CT) image generating system. The system can be installed with an Export function based on the DICOM Image Storage to transfer images and image related data from the CT-Tomoscan to a remote system. This DICOM Export function implies the presence of the CT Tomoscan software release 2.6 or higher.
The DICOM Export function is described in this document.

2.1 Application Data Flow Diagram

The CT-Tomoscan system behaves as a single Application Entity. The related Implementation Model is shown in Figure 2-1 on page 3.

The DICOM Export function can be activated by the CT-Tomoscan operator. The images to be sent are selected from the images of several acquisition runs of the same patient (also called examination). Each image in these runs can be flagged for export or not. At export request the flagged images will be converted into DICOM format and sent out to a remote destination. This destination is previously selected by the operator from the user interface.

Image data transferred are DICOM Computed Tomography (CT) Class instances.
The images transferred are intended for viewing purposes. Postprocessing like MPR, 3D reconstruction and rendering may be possible, depending on the capabilities of the workstation receiving the CT images.
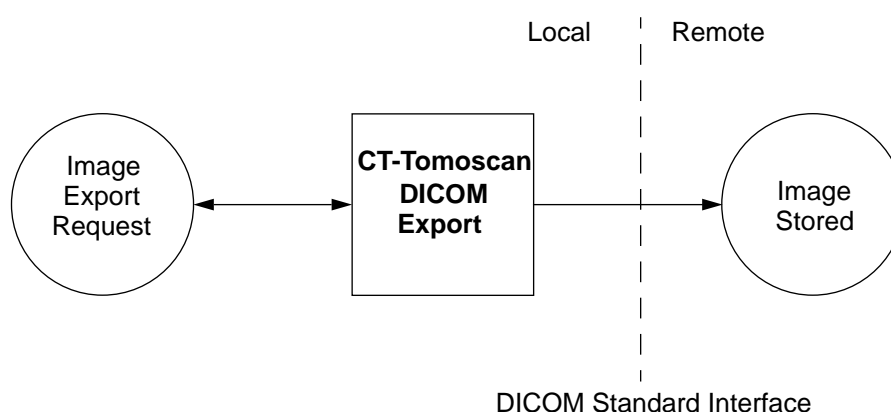
Figure 2-1: CT-Tomoscan DICOM Export Implementation

2.2 Functional definition of Application Entities

The CT-Tomoscan AE acts as a Service Class User (SCU) of the Storage Service Class. The export function acts on the selected images of one examination. When the export is initiated, the AE will open an association to the remote system. The selected images and related image data are converted into a DICOM message to be sent to the remote system.

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Implementation model

The application does not support Storage Service Classes as Service Class Provider (SCP).

2.3 Sequencing of Real World Activities

Not applicable.

3 AE Specifications

3.1 AE CT-Tomoscan DICOM Export Specification

The CT-Tomoscan DICOM Export Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-1: Supported SOP Classes by the CT-Tomoscan DICOM Export AE as SCU

SOP Class Name	UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2

The CT-Tomoscan Application Entity does not support DICOM V3.0 SOP Classes as an SCP.

3.1.1 Association Establishment Policies

3.1.1.1 General

CT-Tomoscan has a configurable maximum PDU size in steps (default is 16K = 16384 bytes).

3.1.1.2 Number of Associations

CT-Tomoscan will attempt to establish one association at a time.

3.1.1.3 Asynchronous Nature

CT-Tomoscan does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: "1.3.46.670589.10.13.800143.1"
The implementation version name is: "HMC/M_TOMO_20"

3.1.2 Association Initiation Policy

CT-Tomoscan initiates associations as a result of the following local Real-World activities:
• The Image Export Request to send the selected images from the CT-Tomoscan to a remote system.

3.1.2.1 Request to send images from CT-Tomoscan to a remote system

3.1.2.1.1　　Associated Real-World Activity

After selection of a peer station and after selection of one of more images of a number of scans, these images will be sent when initiating the Send command. CT-Tomoscan initiates one association to the selected peer entity and uses it to send the selected images via C-STORE requests (and receives the associated C-STORE Responses). The association is released by CT-Tomoscan after successful transfer of the images or when an error occurs.
CT-Tomoscan handles each send request one after another.

3.1.2.1.2   Proposed Presentation Contexts

CT-Tomoscan will propose the following presentation contexts:

Table 3-2: Proposed Presentation Contexts for Send Request

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotia-tion
Name	UID	Name List	UID List		
CT Image Storage - STORE	1.2.840.10008 .5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
CT Image Storage - STORE	1.2.840.10008 .5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

3.1.2.1.3   C-STORE SCU Conformance

CT-Tomoscan has the following behaviour on successful (with or without warnings) and unsuccessful transfer of images:

* Success (return status 0000)
  The successful transfer is indicated on the console: 'Done'.
* Refused (return status A7xx), Error (return status A9xx or Cxxx) and Warning (return status B00x)
  The failed transfer is indicated on the console: 'Network Error'. The reason is not shown.

While busy with transfer, the status Busy is shown on the CT-Tomoscan console.

Extended negotiation is not supported.

Table 3-3 lists the applied Conditional (DICOM Type 1C and 2C) and Optional (DICOM Type 3) attributes of the standard CT Image IOD. These attributes may be empty.
Chapter 8 on page 9 gives an overview of all modules and attribute details.

Table 3-3: Applied Conditional and Optional Attributes of the CT Image IOD

Information Entity	Module	Conditional Attributes	Optional Attributes
Patient	Patient	-	-
Study	General Study	-	-
	Patient Study	-	Admitting Diagnosis Description, Patient's Age

Table 3-3: Applied Conditional and Optional Attributes of the CT Image IOD (Continued)

Information Entity	Module	Conditional Attributes	Optional Attributes
Series	General Series	Patient Position	Series Date, Series Time, Performing Physician's Name, Operators' Name, Protocol Name
Frame of Reference	Frame of Reference	-	-
Equipment	General Equipment	-	Institution Name, Manufacturer's Model Name
Image	General Image	Image Date, Image Time	Referenced Image Sequence, Image Comments
	Image Plane	-	Slice Location
	Image Pixel	-	-
	Contrast/Bolus	-	-
	CT Image	-	Scan Options, Reconstruction Diameter, Gantry/Detector Tilt, Exposure Time, X-Ray Tube Current, Convolution Kernel
	VOI LUT	-	Window Center, Window Width
	SOP Common	Specific Character Set	-

3.1.3 Association Acceptance Policy

The CT-Tomoscan Application Entity does not accept associations.

4 Communication Profiles

4.1 Supported Communication Stacks

CT-Tomoscan provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 TCP/IP Stack

CT-Tomoscan uses the TCP/IP program installed on the PC where CT-Tomoscan DICOM Export is running on. This is a subroutine library that is based on a Berkeley socket interface.

4.2.1 Physical Media Support

CT-Tomoscan supports ISO 8802-3 10BASE5 (Thick-wire), 10BASE2 (Thin-wire) and 10BASE-T (Twisted-pair) Ethernet.

5 Extensions/Specializations/Privatizations

None.

6 Configuration

The CT-Tomoscan system is configured by means of editing the DICOM configuration files on the system running the DICOM Export. This configuration is intended to be used by Philips service engineers only.

6.1 AE Title/Presentation Address mapping

6.1.1 Local AE Titles and Presentation Addresses

The CT-Tomoscan AE title is not configurable; the system chooses an AE title which is unique within a network. This AE title can be seen via the System Administration function.

6.1.2 Remote AE Titles and Presentation Addresses

For remote applications that act as Service Class Provider the following additional information must be provided:
• The AE title.
• The host name and IP address on which the application resides.
• The port number at which the application accepts association requests.

6.2 Configurable parameters

The maximum PDU size is configurable in steps of 1K, 2K, 4K, 8K and 16K.

7 Support of Extended Character Sets

CT-Tomoscan supports the Extended Character Set "ISO_IR 100" which is the Latin alphabet No 1, supplementary set.

8 Overview applied CT Image IOD

The modules selected from the CT Image IOD module table of DICOM 3.0 are given in the table below.

Table 8-1: Applied Modules in the CT Image IOD

Information Entity	Module
Patient	Patient
Study	General Study
	Patient Study
Series	General Series
Frame of Reference	Frame of Reference
Equipment	General Equipment
Image	General Image
	Image Plane
	Image Pixel
	Contrast/Bolus
	CT Image
	VOI LUT
	SOP Common

The details of these applied modules are given in the tables below. The list of possible values are given (if applicable). The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not always shown.

Table 8-2: CT Image Storage SOP Class - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	
Patient ID	0010,0020	
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	Applied value(s): F, M, O

Table 8-3: CT Image Storage SOP Class - General Study Module

Attribute Name	Tag	Note
Study Date	0008,0020	
Study Time	0008,0030	
Accession Number	0008,0050	
Referring Physician's Name	0008,0090	
Study Instance UID	0020,000D	
Study ID	0020,0010	

Table 8-4: CT Image Storage SOP Class - Patient Study Module

Attribute Name	Tag	Note
Admitting Diagnosis Description	0008,1080	May be empty
Patient's Age	0010,1010	

Table 8-5: CT Image Storage SOP Class - General Series Module

Attribute Name	Tag	Note
Series Date	0008,0021	
Series Time	0008,0031	
Modality	0008,0060	Applied value(s): CT
Performing Physician's Name	0008,1050	Empty if not filled in
Operators' Name	0008,1070	Empty if not filled in
Protocol Name	0018,1030	
Patient Position	0018,5100	Applied value(s): FFDL, FFDR, FFP, FFS, HFDL, HFDR, HFP, HFS
Series Instance UID	0020,000E	
Series Number	0020,0011	Value 0 for Scannograms, value 1,2,3... for Slices

Table 8-6: CT Image Storage SOP Class - Frame of Reference Module

Attribute Name	Tag	Note
Frame of Reference UID	0020,0052	
Position Reference Indicator	0020,1040	

Table 8-7: CT Image Storage SOP Class - General Equipment Module

Attribute Name	Tag	Note
Manufacturer	0008,0070	Applied value(s): Philips Medical Systems
Institution Name	0008,0080	Empty if not filled in
Manufacturer's Model Name	0008,1090	Applied value(s): CT Tomoscan M-EG

Table 8-8: CT Image Storage SOP Class - General Image Module

Attribute Name	Tag	Note
Image Date	0008,0023	
Image Time	0008,0033	
Referenced Image Sequence	0008,1140	Present for Axial images, pointing to the related Scannogram
> Reference SOP Class UID	0008,1150	
> Reference SOP Instance UID	0008,1155	
Image Number	0020,0013	
Image Comments	0020,4000	Empty if not filled in

Table 8-9: CT Image Storage SOP Class - Image Plane Module

Attribute Name	Tag	Note
Slice Thickness	0018,0050	
Image Position (Patient)	0020,0032	

Table 8-9: CT Image Storage SOP Class - Image Plane Module (Continued)

Attribute Name	Tag	Note
Image Orientation (Patient)	0020,0037	
Slice Location	0020,1041	
Pixel Spacing	0028,0030	

Table 8-10: CT Image Storage SOP Class - Image Pixel Module

Attribute Name	Tag	Note
Samples per Pixel	0028,0002	See CT Image Module
Photometric Interpretation	0028,0004	See CT Image Module
Rows	0028,0010	
Columns	0028,0011	
Bits Allocated	0028,0100	See CT Image Module
Bits Stored	0028,0101	See CT Image Module
High Bit	0028,0102	See CT Image Module
Pixel Representation	0028,0103	
Pixel Data	7FE0,0010	

Table 8-11: CT Image Storage SOP Class - Contrast/Bolus Module

Attribute Name	Tag	Note
Contrast/Bolus Agent	0018,0010	May be empty

Table 8-12: CT Image Storage SOP Class - CT Image Module

Attribute Name	Tag	Note
Image Type	0008,0008	Applied value(s): ORIGINAL, DERIVED \ PRIMARY, SECONDARY \ AXIAL, LOCALIZER
Scan Options	0018,0022	

Table 8-12: CT Image Storage SOP Class - CT Image Module (Continued)

Attribute Name	Tag	Note
KVP	0018,0060	
Reconstruction Diameter	0018,1100	
Gantry/Detector Tilt	0018,1120	
Exposure Time	0018,1150	
X-Ray Tube Current	0018,1151	
Convolution Kernel	0018,1210	
Acquisition Number	0020,0012	
Samples per Pixel	0028,0002	
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1, MONOCHROME2
Bits Allocated	0028,0100	Applied value(s): 16
Bits Stored	0028,0101	Applied value(s): 12
High Bit	0028,0102	Applied value(s): 11
Rescale Intercept	0028,1052	
Rescale Slope	0028,1053	

Table 8-13: CT Image Storage SOP Class - VOI LUT Module

Attribute Name	Tag	Note
Window Center	0028,1050	
Window Width	0028,1051	

Table 8-14: CT Image Storage SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s): ISO_IR 100
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.2
SOP Instance UID	0008,0018	