Philips Medical Systems
DICOM Conformance Statement

THORAVISION 4.1

Document Number 4512 130 09632
9 June 1997

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
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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 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).

2 Implementation model

THORAVISION 4.1 (and its sub-level releases 4.1.*) of Philips Medical Systems is an Computed Radiography (CR) image generating system. It contains an Export function based on the DICOM Image Storage to transfer image data from the THORAVISION system to a remote system. This DICOM Export function is described in this document.

2.1 Application Data Flow Diagram

The THORAVISION DICOM Export transfers a THORAVISION image to a remote DICOM system. This is activated by an operator request or automatically if the system is configured to do so. A remote destination is selected from the user interface, followed by the selection of the image to be transferred.
Post-processed image data can be transferred (pixel value between 0 and 30,000) as an instance of the DICOM Computed Radiography IOD. The images transferred are intended for viewing purpose and VOI LUT transformation (grayscale transformation) only.

The THORAVISION DICOM Export behaves as a single Application Entity. The related Implementation Model is shown in Figure 2-1 on page 3.

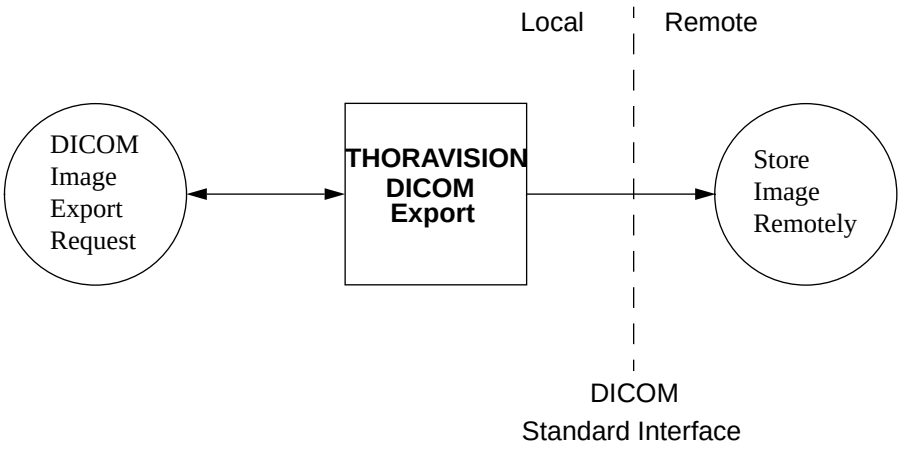

Figure 2-1: THORAVISION DICOM Export Implementation Model

2.2 Functional definition of Application Entities

The THORAVISION DICOM Export application entity acts as a Service Class User (SCU) of the Storage Service Class. After invoking it will open an association to the remote system. For each image to be transported a retrieve action from the internal THORAVISION storage will take place followed by the conversion to a DICOM message to be transferred to the remote system.

2.3 Sequencing of Real World Activities

Not applicable.

3 AE Specifications

THORAVISION DICOM Export acts as a single Application Entity.

3.1 AE THORAVISION DICOM Export Specification

The THORAVISION Export Application Entity provides Standard Extended Conformance to the following DICOM 3.0 SOP class as an SCU:

Table 3-1: Supported SOP class by the THORAVISION Export AE as SCU

SOP class Name	*UID*
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1

The THORAVISION Export Application Entity does not support DICOM 3.0 SOP Classes as SCP.

3.1.1 Association Establishment Policies

3.1.1.1 General

THORAVISION Export will offer a fixed maximum PDU size of 16K = 16384 bytes on the associations initiated by the application itself.

3.1.1.2 Number of Associations

THORAVISION Export will attempt to establish one association at a time.

3.1.1.3 Asynchronous Nature

THORAVISION Export does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: “1.3.46.670589.8.4.1“.
The implementation version name is: “THORAVISION4.1”.

3.1.2 Association Initiation Policy

THORAVISION Export initiates associations as a result of only one Real-World activity and is described below.

3.1.2.1 THORAVISION DICOM Image Export Request

3.1.2.1.1 Associated Real-World Activity

The DICOM Image Export Request can be done on the following ways:

- the operator requests via the User Interface the export the selected THORAVISION image to a remote system,
- the operator requests via the “STORE ALL” function on the User Interface to generate multiple export requests of images,
- the generation of a new THORAVISION image will result in an automatic export of that image when the system is configured in automatic store mode.

For each export request a new association is set-up, than the transfer of the image is started. The association is released when the transfer is ended. The transferred image will not be deleted from the system.
In case of unsuccessful transfer with special response status conditions (e.g. Store SCP down), a new attempt will be done automatically every 30 seconds. These queued export requests can be abort by the operator.

3.1.2.1.2 Proposed Presentation Contexts

THORAVISION Export will propose the following presentation contexts:

Table 3-2: Proposed Presentation Contexts for THORAVISION Export

Presentation Context table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.2.1.2.1 SOP Specific Conformance to Storage SOP Classes

THORAVISION provides standard conformance to the Storage Service Class.

The status of the C-STORE Response (Success, Refused, Error, Warning) will be displayed via the user interface.

Extended negotiation is not supported.

Table 3-3 lists the applied optional and extended modules and attributes of the CR IOD. Conditional attributes Patient Orientation (type 2C), Image Date (type 2C), Image Time (type 2C), Specific Character Set (type 1C) are always present.

Table 3-3: Applied optional Modules and Attributes of the applied CR IOD

IE	*Module*	*Optional Attributes*
Patient	Patient	Other Patient's ID
Study	General Study	Study Description
Series	General Series	Series Date, Series Time
	CR Series	Filter Type, Collimator/grid Name, Focal Spot(s), Plate Type
Equipment	General Equipment	Institution Name, Station Name, Institutional Department Name, Manufacturer's Model name, Device Serial Number, Software Version(s), Date of Last Calibration, Time of Last Calibration
Image	General Image	Image Type, Image Comments
	Image Pixel	-
	CR Image	KVP, Distance Source to Detector, Exposure Time, Exposure, Generator Power, Sensitivity
	VOI LUT (applied optional module)	Window Center, Window Width
	SOP Common	-

A detailed overview of the applied CR Image IOD is given in section 8 on page 9.

3.1.3 Association Acceptance Policy

THORAVISION 4.1 does not accept associations.

4 Communication Profiles

4.1 TCP/IP Stack

THORAVISION Release 4.1 provides DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM 3.0 Standard.

4.1.1 Physical Media Support

The THORAVISION system supports ISO 8802-3 10BASE5 Ethernet.

5 Extensions/Specializations/Privatizations

The CR Image Storage SOP Class is Standard Extended with additional Standard Type 3 attributes and with one additional private attribute, as specified in the table below.

Table 5-1: Applied extended Modules and applied extended Attributes

IE	*Module*	*Extended Attributes*
Image	CR Image (extended module)	Preprocessing Function (from standard NM Image Module), Post Processing Function (from standard NM Image Module), Pixel Spacing (from standard Image Plane Module), Image Area Dose Product (from X-Ray Acquisition Module) Private Creator (private attribute), Stamp Image Sequence containing (Samples per Pixel, Photometric Interpretation, Rows, Columns, Bits Allocated, Bits Stored, High Bit, Pixel Representation, Pixel Data)
	X-Ray Collimator (additional standard module)	Collimator Shape, Collimator Left Vertical Edge, Collimator Right Vertical Edge, Collimator Upper Horizontal Edge, Collimator Lower Horizontal Edge

See the CR Image overview in section 8 on page 9.

6 Configuration

The configuration of a THORAVISION system is done by means of updating configuration files. This should be done by Philips service engineers only.

6.1 AE Title/Presentation Address mapping

6.1.1 Local AE Titles and Presentation Addresses

The local Application Entity Title and Presentation Address are configurable.

6.1.2 Remote AE Titles and Presentation Addresses

All remote applications to be selected as export destination (SCP) are configurable for the following items:

- The Application Entity Title of the remote application.
- The Presentation Address at which the remote application should accept association requests.
- The Remote Host Name of the system on which the remote application resides.

6.2 Configurable parameters

- The supported Extended Character Set
  Default Character Set is ISO-IR 100 which is the Latin alphabet No. 1, supplementary set.
- Whether a RIS is connected to THORAVISION or not (this influences some attribute values of the exported DICOM images; see section 8 on page 9)
- Whether automatic transfer of generated images will be done to a configured destination or not (i.e. the automatic store mode which can be switched on or off; see section 3.1.2.1 on page 5)

7 Support of Extended Character Sets

THORAVISION Export supports Character Sets ISO-IR 100 (which is default), ISO-IR 101, ISO-IR 109, ISO-IR 110, ISO-IR 144, ISO-IR 127, ISO-IR 126, ISO-IR 138, ISO-IR 148.

8 Overview of the applied Extended Computed Radiography IOD

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

Table 8-1: Applied Modules in the Extended CR IOD

IE	*Module*
Patient	Patient
Study	General Study
Series	General Series
	CR Series
Equipment	General Equipment
Image	General Image
	Image Pixel
	Extended CR Image
	X-Ray Collimator
	VOI LUT
	Stamp Image
	SOP Common

The details of these applied modules are given in the tables below. The list of possible attribute 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.

Table 8-2: Patient Module

Attribute Description	*Tag*	*Note*
Patient’s Name	0010,0010	Received from the RIS or filled in by operator or is empty.
Patient ID	0010,0020	Received from the RIS or filled in by operator or is empty.
Patient's Birth Date	0010,0030	Received from the RIS or filled in by operator or is empty.
Patient's Sex	0010,0040	Received from the RIS or filled in by operator or is empty. Applied value(s): F, M, O

Table 8-2: Patient Module (Continued)

Attribute Description	*Tag*	*Note*
Other Patient IDs	0010,0100	Received from the RIS or filled in by operator or is empty.

Table 8-3: General Study Module

Attribute Description	*Tag*	*Note*
Study Date	0008,0020	
Study Time	0008,0030	
Accession Number	0008,0050	Received from the RIS or filled in by operator or is empty.
Referring Physician's Name	0008,0090	Received from the RIS or filled in by operator or is empty.
Study Description	0008,1030	Received from the RIS or filled in by operator or is empty.
Study Instance UID	0020,000D	Received from the RIS or filled in by operator.
Study ID	0020,0010	

Table 8-4: General Series Module

Attribute Description	*Tag*	*Note*
Series Date	0008,0021	
Series Time	0008,0031	
Modality	0008,0060	Applied value(s): CR
Series Instance UID	0020,000E	Generated by the system such that each Series contains only one image (because usually the View Position of the images is different).
Series Number	0020,0011	Is unique within a Study.

Table 8-5: CR Series Module

Attribute Description	*Tag*	*Note*
Body Part Examined	0018,0015	Applied value(s): CHEST
Filter Type	0018,1160	
Collimator/grid Name	0018,1180	

Table 8-5: CR Series Module (Continued)

Attribute Description	*Tag*	*Note*
Focal Spot(s)	0018,1190	
Plate Type	0018,1260	May have a zero length value
View Position	0018,5101	Applied value(s): AP, PA, LL, RL

Table 8-6: General Equipment Module

Attribute Name	*Tag*	*Note*
Manufacturer	0008,0070	Applied value(s): Philips Medical Systems
Institution Name	0008,0080	Zero length value if not entered by the operator
Station Name	0008,1010	
Institutional Department Name	0008,1040	
Manufacturer’s Model Name	0008,1090	
Device Serial Number	0018,1000	
Software Version(s)	0018,1020	
Date of Last Calibration	0018,1200	May have a zero length value
Time of Last Calibration	0018,1201	May have a zero length value

Table 8-7: General Image Module

Attribute Name	*Tag*	*Note*
Image Type	0008,0008	Applied value(s): DERIVED\PRIMARY
Image Date	0008,0023	
Image Time	0008,0033	
Image Number	0020,0013	Is unique within one Study. Is composed of the acquisition number and a post processing number
Patient Orientation	0020,0020	
Image Comments	0020,4000	Zero length value if not entered by the operator

Table 8-8: Image Pixel Module

Attribute Name	*Tag*	*Note*
Samples per Pixel	0028,0002	Applied value(s): 1
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1
Rows	0028,0010	Format and collimator dependent: Portrait: max. Rows = 2260 Landscape: max. Rows = 1860 Square: max. Rows = 2447
Columns	0028,0011	Format and collimator dependent: Portrait: max. Columns = 1860 Landscape: max. Columns = 2260 Square: max. Columns = 2166
Bits Allocated	0028,0100	Applied value(s): 16
Bits Stored	0028,0101	Applied value(s): 15
High Bit	0028,0102	Applied value(s): 14
Pixel Representation	0028,0103	Applied value(s): 0000H
Pixel Data	7FE0,0010	Between 0 and 30,000

Table 8-9: Extended CR Image Module[a]

Attribute Name	*Tag*	*Note*
KVP	0018,0060	
Distance Source to Detector	0018,1110	
Exposure Time	0018,1150	
Exposure	0018,1152	
Image Area Dose Product[a]	0018,115E	
Generator Power	0018,1170	

Table 8-9: Extended CR Image Module[a] (Continued)

Attribute Name	*Tag*	*Note*
Preprocessing Function[a]	0018,5020	will contain 8 values separated by commas: • Scale per Decade: no meaning for DERIVED\PRIMARY image types • Chamber Average: no meaning for DERIVED\PRIMARY image types • Minimum pixel value • Median value, 1% less than minimum pixel value • Median value, 2% less than minimum pixel value • Median value, 50% less than minimum pixel value • Median value, 98% less than minimum pixel value • Maximum pixel value
Postprocessing Function[a]	0018,5021	
Sensitivity	0018,6000	
Pixel Spacing[a]	0028,0030	Empty if not known

a. Additional attribute in the module; classifies the applied SOP Class as Extended SOP Class.

Table 8-10: X-Ray Collimator Module

Attribute Name	*Tag*	*Note*
Collimator Shape	0018,1700	Applied value(s): RECTANGULAR
Collimator Left Vertical Edge	0018,1702	
Collimator Right Vertical Edge	0018,1704	
Collimator Upper Horizontal Edge	0018,1706	
Collimator Lower Horizontal Edge	0018,1708	

Table 8-11: VOI LUT Module

Attribute Name	*Tag*	*Note*
Window Center	0028,1050	Is fixed. Applied value(s): 15,000
Window Width	0028,1051	Is fixed. Applied value(s): 30,000

Table 8-12: (Private) Stamp Image Module

Attribute Name	*Tag*	*Note*
Private Creator	0089,00xx	VR is LO VM is 1 Value is PMS-THORA-3.1
Stamp Image Sequence	0089,xx20	VR is SQ VM is 1
> Samples per Pixel	0028,0002	Applied value(s): 1
> Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1
> Rows	0028,0010	Max. 512
> Columns	0028,0011	Max. 512
> Bits Allocated	0028,0100	Applied value(s): 8
> Bits Stored	0028,0101	Applied value(s): 8
> High Bit	0028,0102	Applied value(s): 7
> Pixel Representation	0028,0103	Applied value(s): 0000
> Pixel Data	7FE0,0010	

Table 8-13: SOP Common Module

Attribute Name	*Tag*	*Note*
Specific Character Set	0008,0005	ISO_IR 100 is default. Applied value(s): ISO_IR 100, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 126, ISO_IR 127, ISO_IR 138, ISO_IR 144, ISO_IR 148
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.1
SOP Instance UID	0008,0018	