Philips Medical Systems
DICOM Conformance Statement

USIT 1.5 L3

Document Number 4512 131 81001
19 February 2004

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1 Introduction

This section provides general information about the scope, intended audience and contents of this Conformance Statement and how to use it.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange between equipment of Philips Medical Systems and with equipment of other vendors. This document specifies the compliance to the DICOM standard, formally called the NEMA PS 3.X 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), Service Elements 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) clients,
- marketing staff interested in data exchange functionality,
- system integrators and Customer Support Engineers of medical equipment,
- software engineers 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 section 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.
Additionally, the sections following 7 (if present) specify the details of the applied IODs and Service Elements.

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.
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)
National Electrical Manufacturers Association (NEMA) Publication Sales
1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

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 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
- EBE Explicit VR Big 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
- PACS Picture ArChiving System
- 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

This DICOM Conformance Statement specifies the DICOM behaviour of the USIT 1.5 system of Philips Medical System. The USIT 1.5 is a part of the PCR system. This PCR system consists of the EasyVision Rad 4.2 (short EV) and the "PCR User Interface Terminal" (USIT 1.5).

PCR is able to generate Computed Radiography (CR) images. A worklist can be obtained to provide RIS information about procedures that should be performed on a specific patient. Therefore, this document will specify the DICOM behaviour of the USIT 1.5.

2.1 Application Data Flow Diagram

The USIT 1.5 system behaves as a single application entity. The related Implementation Model is shown in Figure 2-1 on page 4.

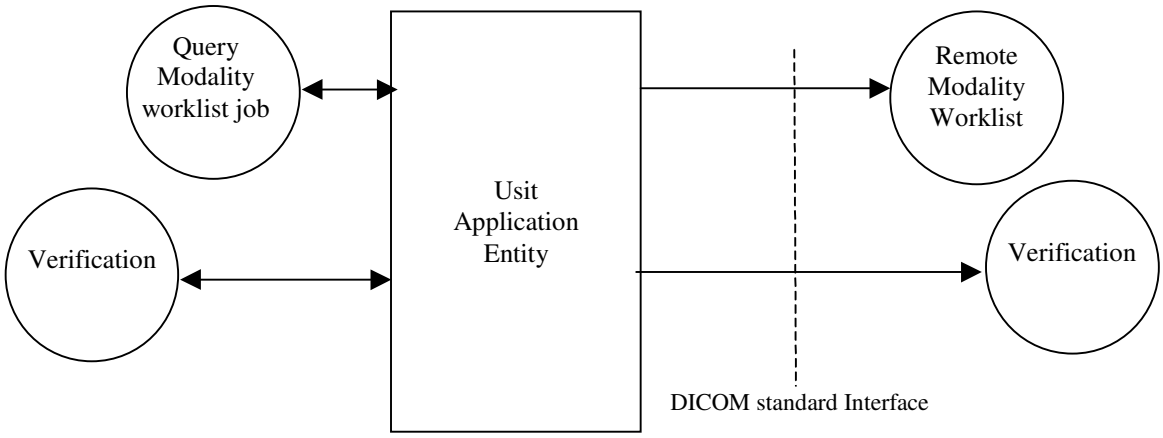

Figure 2-1: USIT 1.5 Application Entity

The USIT 1.5 can query an Information system like a RIS or HIS, to obtain a DIOCM Modality Worklist. Also a DICOM verification can be performed.

2.2 Functional definition of Application Entities

The USIT 1.5 application entity acts as a service class user of Verification and Worklist Management service classes.

The USIT 1.5 DICOM Worklist function acts as a Service Class User (SCU) of the Basic Worklist Management Service Class. It will subsequently request the Worklist, it will receive the data from the configured RIS and the data can be send to other components of the PCR system.

2.3 Sequencing of Real World Activities

An Information System like a RIS or HIS provides information about procedures that should be performed on a specific patient. The modality offers the operator a worklist.
The operator can select a patient/ examination /view and produce images for it.

In Figure 2-2 on page 5 a global overview of the USIT 1.5 Network environment is given.

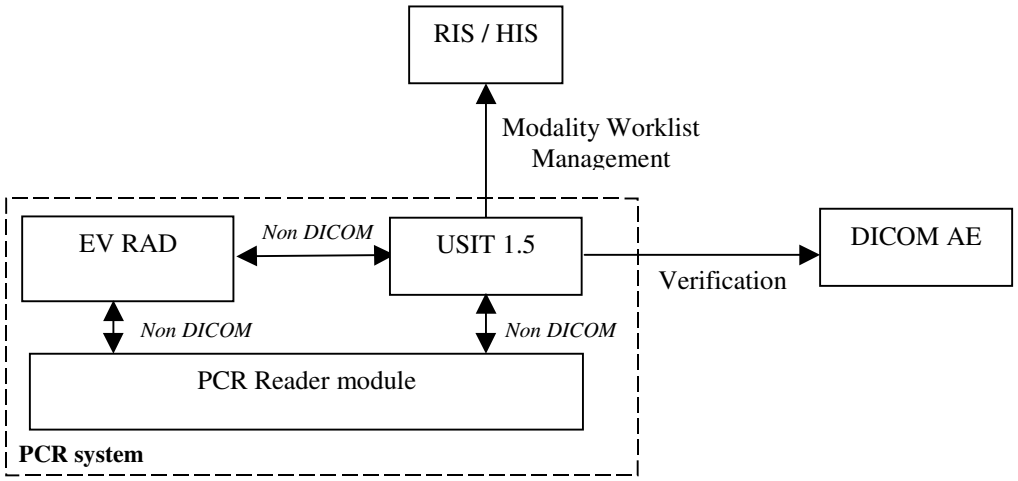

Figure 2-2: The USIT 1.5 in a DICOM network

3 AE Specifications

3.1 AE USIT 1.5 Specification

The USIT 1.5 Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an SCU:

Table 3-1: Supported SOP classes by the USIT 1.5 AE as SCU

SOP class Name	UID
Verification SOP Class	1.2.840.10008.1.1
Modality Worklist Information Model- FIND SOP Class	1.2.840.10008.5.1.4.31

The USIT 1.5 Application Entity doesn't support DICOM V3.0 SOP classes as an SCP.

3.1.1 Association Establishment Policies

3.1.1.1 General

The default PDU size is 16k.

3.1.1.2 Number of Associations

The number of simultaneous associations supported by USIT 1.5 as a service class user is limited to one.

3.1.1.3 Asynchronous Nature

USIT 1.5 does not support asynchronous operations and will not perform asynchronous window negotiation.

Implementation Identifying Information:
The Implementation Class UID is: 1.3.46.670589.9.1.1.1.5.3
The implementation version name is: USIT 1.5L3

3.1.2 Association Initiation Policy

USIT 1.5 initiates associations as a result of the following events:

- The USIT 1.5 automatically requests a Modality Worklist, the worklist is queried regularly with a configurable interval.
- The USIT 1.5 operator performs a Verification.

3.1.2.1 Verification

3.1.2.1.1 Associated Real-World Activity

An association can be made to verify application level communication using the C-ECHO command.

3.1.2.1.2 Proposed Presentation Contexts

USIT 1.5 will propose the following presentation contexts

Table 3-1: Proposed Presentation Contexts:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	ILE	1.2.840.10008.1.2	SCU	None
		ELE	1.2.840.10008.1.2.1	SCU	None
		EBE	1.2.840.10008.1.2.2	SCU	None

3.1.2.1.3 Conformance to verify

USIT 1.5 provides standard conformance.

3.1.2.2 .Worklist Request

3.1.2.2.1 Associated Real-World Activity

The worklist is queried regularly with a configurable interval. USIT 1.5 initiates an association to the selected peer entity and uses it to send C-FIND requests. The association is released when the find execution completes.

3.1.2.2.2 Proposed Presentation Contexts

USIT 1.5 will propose the following presentation contexts:

Table 3-1: Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model- FIND SOP Class	1.2.840.10008.5.1.4.31	ILE	1.2.840.10008.1.2	SCU	None
		ELE	1.2.840.10008.1.2.1	SCU	None
		EBE	1.2.840.10008.1.2.2	SCU	None

3.1.2.2.3 C-FIND SCU Conformance

Following are the status codes that are processed by the USIT Modality Worklist AE when received from a remote Modality Worklist SCP system:

Table 3-1: WLM STATUS

Service Status	Status Codes	Further Meaning	Behaviour upon receiving Status Codes
Refused	A700	Out of resources	Processing of the matches and the association is terminated. A message appears on the User Interface.
Failed	A900	Identifier does not match SOP Class	The association is terminated and the status is logged into the system error log. A message appears on the User Interface.
	Cxxx	Unable to process	Processing of the matches and the association is terminated. A message appears on the User Interface.
Cancel	FE00	Matching terminated due to cancel	Processing of the matches and the association is terminated. A message appears on the User Interface.
All other status codes	xxxx		A message appears on the User Interface.
Success	0000	Matching is complete - No final identifier is supplied	The association is released and the matches received are stored.

The modules selected from the modality Worklist Information Model IOD module table of DICOM 3.0 are given in the table below. The list of possible attribute values are given.

Limited characters are supported by the USIT in the Patient ID, Patient Name and Patient current location. See Chapter 7.

If Scheduled Procedure Steps apear in one query and are vanished in a later query, the USIT removes the mapped examinations from the user worklist, if those have not already been started.

USIT supports 4 configurable ways to map a RIS Procedure (or Protocol) Code onto an Examination that is scheduled on the USITs worklist.

Examination is selected from Scheduled Protocol Code Items->Code Value (0040,0008)/(0008,0100)
Examination is selected from Scheduled Procedure Step Description (0040,0007)
Examination is selected from Requested Procedure Code Items->Code Value (0032,1064)
Examination is selected from Requested Procedure Description (0032,1060)/(0008,0100)

Whatever attribute is chosen by configuration for mapping is called "procedure code" in this conformance statement from here on.

Important note:
The "Description" attributes (0040,0007) and (0032,1060) have a long string value representation and can store longer procedure codes than the Code Value (0008,0100) which can store 16 characters. The interpretation of codes by the USIT is limited to 15 characters, independent from which of these 4 attributes is configured as source of the procedure code to map onto. If a Scheduled Procedure Step contains a procedure code longer than 15 characters, it will not be scheduled

USIT does not evaluate the attributes; Coding Scheme Version (008,0103), Coding Scheme Designator (0008,0102), Code Meaning (0008,0104), but only the Code Value (0008,0100), for mapping the examination settings.

Usit 1.5 will process the following attributes when received from RIS:

Table 3-2: Processing of Worklist attributes

DICOM Module	DICOM Tag	DICOM Name	Disp. on USIT	Transf. to EV
General	(0008,0005)	Specific Character Set	(1)	(1)
Patient	(0010,0010)	Patient Name	*	*
	(0010,0020)	Patient ID	*	*
	(0010,0030)	Patient Birth Date	*	*
	(0010,0040)	Patient Sex	*	*
Study	(0020,000D)	Study Instance UID		*
	(0008,0050)	Accession Number	*	*
	(0008,0090)	Study Referring Physician Name		*
Scheduled Procedure Step	(0040,0100)	Scheduled Procedure Step Sequence		
	(0040,0002)	Scheduled Procedure Step Start Date	*	
	(0040,0003)	Scheduled Procedure Step Start Time	*	
	(0040,0007)	Scheduled Procedure Step Description		(2)
	(0040,0008)	Scheduled Protocol Code Sequence		
	> (0008,0100)	Code Value		(2)
	(0040,0009)	Scheduled Procedure Step ID	(1)	
Visit	(0038,0400)	Patient's Institution Residence	*	*
Request	(0032,1064)	Requested Procedure Code Sequence		
Code	(0008,0100)	Code Value	(1)	(2)
	(0032, 1060)	Request Procedure Description		(2)

(1) Processed internally, not displayed
(2) Used as "procedure codes" to be mapped onto Examinations in the USIT. Which one is regarded by USIT is configurable.

Usit 1.5 will request the following attributes in the Worklist Query:

Table 3-3: Modality Worklist Information Model - FIND SOP Class - Imaging Service Request Module

Attribute Name	Tag	Note
Accession Number	0008,0050	
Requesting Physician	0032,1032	
Requesting Service	0032,1033	
Imaging Service Request Comments	0040,2400	

Table 3-4: Modality Worklist Information Model - FIND SOP Class - Patient Demographic Module

Attribute Name	Tag	Note
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	

Attribute Name	Tag	Note
Ethnic Group	0010,2160	
Patient Comments	0010,4000	

Table 3-5: Modality Worklist Information Model - FIND SOP Class - Patient Identification Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	This attribute may not contain several characters, see Chapter 7. On receiving these character the processing is terminated. Patient's Name is divided by DICOM delimiters ("^") into 3 field: Last name, first name and middle name. The maximum length of the last name field is 24, the maximum of the first and middle name is 19 characters. When the maximum length of a field is exceeded the field is truncated.
Patient ID	0010,0020	This attribute may not contain several characters, see Chapter 7. On receiving these character the following message appear: "DICOM /WLM RIS attribute (0x0010,0x0020) has an invalid character at position x)". The processing is terminated.
Other Patient IDs	0010,1000	

Table 3-6: Modality Worklist Information Model - FIND SOP Class - Patient Medical Module

Attribute Name	Tag	Note
Medical Alerts	0010,2000	
Additional Patient History	0010,21B0	
Pregnancy Status	0010,21C0	

Table 3-7: Modality Worklist Information Model - FIND SOP Class - Requested Procedure Module

Attribute Name	Tag	Note
Referenced Study Sequence	0008,1110	
> Referenced SOP Class UID	0008,1150	
> Referenced SOP Instance UID	0008,1155	

Attribute Name	Tag	Note
Study Instance UID	0020,000D	
Requested Procedure Description	0032,1060	Can be used as USITs procedure code (configurable).
Requested Procedure Code Sequence	0032,1064	
> Code Value	0008,0100	Can be used as USITs procedure code (configurable).
> Coding Scheme Designator	0008,0102	
> Coding Scheme Version	0008,0103	
> Code Meaning	0008,0104	
Requested Procedure ID	0040,1001	
Names of Intended Recipients of Results	0040,1010	
Requested Procedure Comments	0040,1400	

Table 3-8: Modality Worklist Information Model - FIND SOP Class - Scheduled Procedure Step Module

Attribute Name	Tag	Note
Scheduled Procedure Step Sequence	0040,0100	
> Modality	0008,0060	Can be used as matching Key. Multiple values can be applied (comma seperated)
> Requested Contrast Agent	0032,1070	
> Scheduled Station AE Title	0040,0001	
> Scheduled Procedure Step Start Date	0040,0002	Can be used as matching Key.
> Scheduled Procedure Step Start Time	0040,0003	
> Scheduled Procedure Step End Date	0040,0004	
> Scheduled Procedure Step End Time	0040,0005	
> Scheduled Performing Physician's Name	0040,0006	
> Scheduled Procedure Step Description	0040,0007	Can be used as USITs procedure code (configurable).
> Scheduled Action Item Code Sequence	0040,0008	
>> Code Value	0008,0100	Can be used as USITs procedure code (configurable).
>> Coding Scheme Designator	0008,0102	

Attribute Name	Tag	Note
>> Coding Scheme Version	0008,0103	
>> Code Meaning	0008,0104	
> Scheduled Procedure Step ID	0040,0009	
> Scheduled Station Name	0040,0010	
> Scheduled Procedure Step Location	0040,0011	
> Pre-Medication	0040,0012	
> Scheduled Procedure Step Status	0040,0020	
> Comments on the Scheduled Procedure Step	0040,0400	

Table 3-9: Modality Worklist Information Model - FIND SOP Class - Visit Admission Module

Attribute Name	Tag	Note
Referring Physician's Name	0008,0090	

Table 3-10: Modality Worklist Information Model - FIND SOP Class - Visit Status Module

Attribute Name	Tag	Note
Current Patient Location	0038,0300	This attribute may not contain several characters, see Chapter 7. On receiving these character the processing is terminated.
Patient's Institution Residence	0038,0400	

Table 3-11: Modality Worklist Information Model - FIND SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	

4 Communication Profiles

4.1 Supported Communication Stacks

The USIT 1.5 application provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

5 Extensions/Specializations/Privatizations

No extended SOP Classes are used.

6 Configuration

6.1 AE Title/Presentation Address mapping

6.1.1 Local AE Titles and Presentation Addresses

The service engineer must provide the following information for the local AE:
- The USIT 1.5 AE title
- USIT Modality (default to “CR”)

6.1.2 Remote AE Titles and Presentation Addresses

All remote applications that wish to communicate with USIT 1.5 must be defined at USIT 1.5 configuration time. The service engineer must provide the following information for each remote application:
- The application entity title of RIS server.
- IP address of RIS server
- IP port for DICOM queries on RIS server

6.2 Configurable parameters

The following items are also configurable:
- Query repetition interval (i.e. the amount of time between two RIS queries)
- Selection of Attributes that will be used for broad WLM query.
- A combination of zero, one or more of the three options can be set:
  + Query for Scheduled Procedure Steps scheduled for the USITs AET only
  + Query for Scheduled Procedure Steps scheduled for a modality ("CR", or "CR,RF", ...) only
  + Query for Scheduled Procedure Steps with scheduled start date of today only

7 Support of Extended Character Sets

USIT 1.5 supports Extended Character Set “ISO_IR 100” which is the Latin alphabet No 1, supplementary set.

Some international characters that can be transferred via DICOM cannot be displayed on the USIT 1.5 A list of supported characters is shown in Figure 7-1 on page 17.

Table 7-1: Supported ASCII characters

ASCII Code (1) (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation	ASCII Code (dec.)	Represen-tation
32	" '(2)	128	Ç	149	ò	211	Ë
35	#(2)(3)	129	ü	150	û	212	È
37	%(2)(3)	130	é	151	ù	214	Í
40	(2)(3)	131	â	153	Ö	215	Î
41	)(2)(3)	132	ä	154	Ü	216	Ï
42	*(2)(3)	133	à	155	ø	222	Ì
43	+(2)(3)	134	å	157	Ø	224	Ó
44	,	135	ç	160	á	225	ß
45	-	136	ê	161	í	226	Ô
46	.	137	ë	162	ó	227	Ò
47	/	138	è	163	ú	228	õ
48-57	0-9	139	ï	164	ñ	229	Õ
58	:	140	î	165	Ñ	231	þ
59	;(2)(3)	141	ì	181	Á	232	Þ
60	<(2)(3)	142	Ä	182	Â	233	Ú
61	=(2)(3)	143	Å	183	À	234	Û
62	>(2)(3)	144	É	198	ã	235	Ù
65-90	A-Z	145	æ	199	Ã	236	ý
95	_	146	Æ	208	ð	237	Ý
96	'	147	ô	209	Ð		
97-122	a-z	148	ö	210	Ê		

Table 1: Supported ASCII characters

(1) The ASCII codes > 127 are based on PC Codepage 850 (Multilingual)
(2) Not allowed in Patient ID attribute
(3) Not allowed in Patient Name and Patient’s Institution Residence attribute