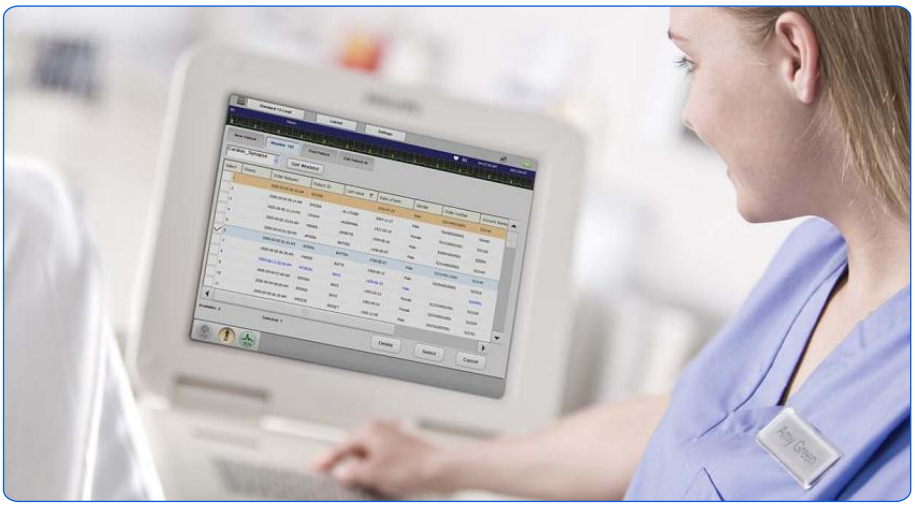
DICOM Conformance Statement

ECG Gateway EG100



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1. DICOM Conformance Statement Overview

This Conformance Statement refers to the ECG Gateway EG100.

Philips PageWriter cardiographs are as easy to use as 1-2-3, and now the Philips EG100 ECG Gateway software solution helps you find even greater productivity through increased interoperability with your information systems. Working with PageWriter's familiar applications and interface, the ECG Gateway software quickly and accurately downloads worklist information or a patient's demographic information with a barcode scan or a few quick interactions with the touchscreen display.

The following Table presents an overview of all network services and the applicable SOP Classes as provided by the ECG Gateway EG100, where the first column specifies the used SOP Classes as named in PS 3.6 (Ref PS 3.2 Annex A) of the current DICOM Standard. The following Table presents an overview of all network services and the applicable SOP Classes as provided by the Intellispace Portal Workspace, where the first column specifies the used SOP Classes as named in PS 3.6 (Ref PS 3.2 Annex A) of the current DICOM Standard.

The ECG Gateway EG100 provides the following DICOM data exchange features:

- DICOM Modality Worklist

Table 1: Network Services

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Workflow Management			
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.31	Yes	No

2. Table of Contents

3. Introduction

The introduction specifies product and relevant disclaimers as well as any general information that the vendor feels is appropriate.

3.1. Revision History

The revision history provides dates and differences of the different releases.

Table 2: Revision History

Document Version	Date of Issue	Status	Description
00	14-June-2011	Draft	Initial version
01	21-July-2011	Approved	Final version

3.2. 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.

3.3. Remarks

The DICOM Conformance Statement is contained in chapter 4 through 8 and follows the contents and structuring requirements of DICOM PS 3.2.
This DICOM 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 an IT 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 analyze 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). 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).

3.4. Definitions, Terms and Abbreviations

Table 3: Definitions, Terms and Abbreviations

Abbreviation/Term	Explanation
AE	Application Entity
ANSI	American National Standard Institute
AP	Application Profile
BOT	Basic Offset Table
CD	Compact Disc
CD-R	CD-Recordable
CD-M	CD-Medical
CR	Computed Radiography
CT	Computed Tomography
DCR	Dynamic Cardio Review
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DIMSE-Composite
DIMSE-N	DIMSE-Normalized
DX	Digital X-Ray
EBE	DICOM Explicit VR Big Endian
ELE	DICOM Explicit VR Little Endian
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
GUI	Graphic User Interface
HIS	Hospital Information System
HL7	Health Level Seven
ILE	DICOM Implicit VR Little Endian
IOD	Information Object Definition
ISIS	Information System - Imaging System
MOD	Magneto-Optical Disk
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance
NEMA	National Electrical Manufacturers Association
NM	Nuclear Medicine
PDU	Protocol Data Unit
RF	X-Ray Radiofluoroscopic
RIS	Radiology Information System
RT	Radiotherapy
RWA	Real-World Activity
SC	Secondary Capture
SCM	Study Component Management
SCP	Service Class Provider
SCU	Service Class User

Abbreviation/Term	Explanation
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
US	Ultrasound
USMF	Ultrasound Multi-frame
WLM	Worklist Management
XA	X-Ray Angiographic

3.5. References

[DICOM] Digital Imaging and Communications in Medicine, Parts 1 - 18 (NEMA PS 3.1- PS 3.18),
National Electrical Manufacturers Association (NEMA)
Publication Sales 1300 N. 17th Street, Suite 1752
Rosslyn, Virginia. 22209, United States of America
Internet: http://medical.nema.org/
Note that at any point in time the official standard consists of the most recent yearly edition of the base standard (currently 2009) plus all the supplements and correction items that have been approved as Final Text.

4. Networking

This section contains the networking related services.

4.1. Implementation model

The implementation model consists of three sections:

- The application data flow diagram, specifying the relationship between the Application Entities and the "external world" or Real-World Activities,
- A functional description of each Application Entity, and
- The sequencing constraints among them.

4.1.1. Application Data Flow

The ECG Gateway EG100 MWL SCU sends a request, coming from an ECG device, for study data from a DICOM Modality Worklist SCP. When the SCP responses are received, the content will be processed and provided back for the patient and study information to the ECG device.

The figure below shows the application data flow as a functional overview.

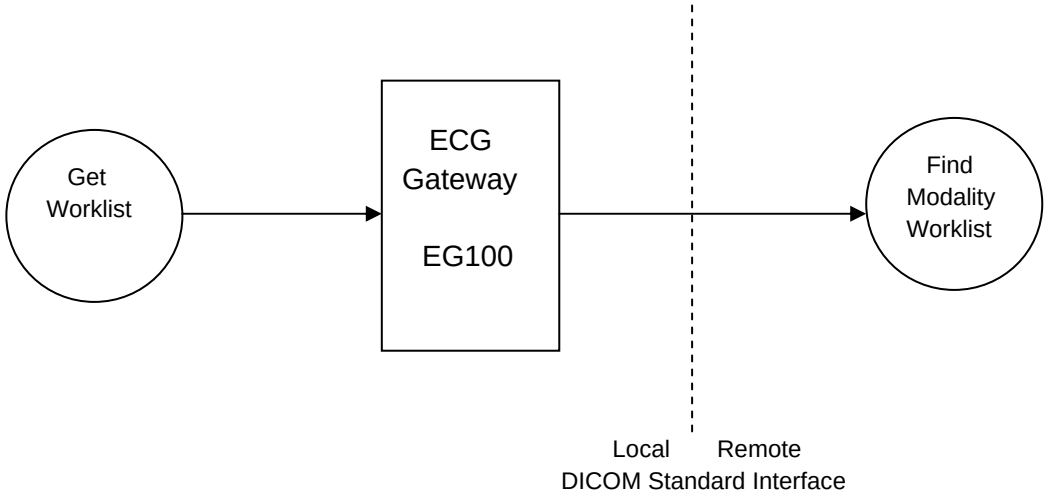

Figure 1: Network Application Data Flow Diagram

4.1.2. Functional Definition of AE's

This section contains a functional definition for each individual local Application Entity.

4.1.2.1. Functional Definition of ECG GATEWAY EG100 MWL

The ECG Gateway EG100 MWL provides a DICOM modality Worklist SCU function to provide study details to the requesting ECG device.

4.1.3. Sequencing of Real World Activities

The figure below shows a typical sequence for Real World Activity Get Worklist request to a DICOM modality Worklist SCP.

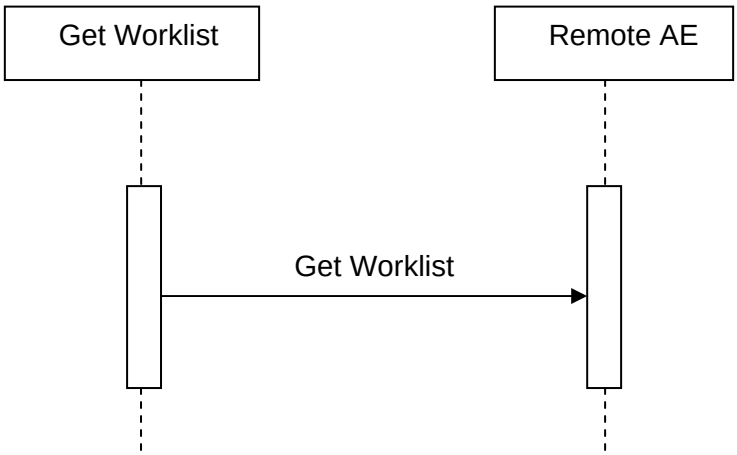

Figure 2: (Real World) Activity - Worklist Request

4.2. AE Specifications

This section in the DICOM Conformance Statement is a set of Application Entity specifications. There are as many of these subsections as there are different AE's in the implementation.

4.2.1. ECG Gateway EG100 DMWL

Detail of this specific Application Entity is specified in this section.

4.2.1.1. SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes.

Table 4: SOP Classes for ECG GATEWAY EG100 MWL

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.31	Yes	No

Note: Any SOP specific behavior is documented later in the conformance statement in the applicable SOP specific conformance section.

4.2.1.2. Association Policies

Each AE specification contains a description of the general association establishment and acceptance policies of the AE.

4.2.1.2.1. General

The DICOM standard application context is specified below.

Table 5: DICOM Application Context

Description	Value
Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2. Number of Associations

The number of simultaneous associations that an Application Entity may support as a Initiator or Acceptor is specified here.

Table 6: Number of associations as an Association Initiator for this AE

Description	Value
Maximum number of simultaneous associations	1

4.2.1.2.3. Implementation Identifying Information

The value supplied for Implementation Class UID and version name are documented here.

Table 7: DICOM Implementation Class and Version for ECG GATEWAY EG100 MWL

Implementation Class UID	1.3.46.670589.49.2.1.1
Implementation Version Name	IOAPI_2_1_1

4.2.1.2.4. Communication Failure Handling

The behavior of the AE during communication failure is summarized in the next table.

Table 8: Communication Failure Behavior

Exception	Behavior	Comment
ARTIM Timeout	The system stops the ARTIM timer and close the transport connection.	Configurable, default value=60
Association Timeout	A release request is sent in order to close the association.	Configurable, default value=60

4.2.1.3. Association Initiation Policy

The Application Entity will respond to a received Association rejection as shown in the next table.

Table 9: Association Rejection response

Result	Source	Reason/Diagnosis	Behavior
1 - rejected-permanent	1 - DICOM UL service-user	1 - no-reason-given	No return, connection closed
		2 - applicaton-context-name-not supported	No return, connection closed
		3 - calling-AE-title-not-recognized	No return, connection closed
		7 - called-AE-title-not-recognized	No return, connection closed
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	No return, connection closed
		2 - protocol-version-not-supported	No return, connection closed
	3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion	No return, connection closed
		2 - local-limit-exceeded	No return, connection closed
2 - rejected-transient	1 - DICOM UL service-user	1 - no-reason-given	No return, connection closed
		2 - application-context-name-not-supported	No return, connection closed
		3 - calling-AE-title-not-recognized	No return, connection closed
		7 - called-AE-title-not-recognized	No return, connection closed
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	No return, connection closed
		2 - protocol-version-not-supported	No return, connection closed
	3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion	No return, connection closed
		2 - local-limit-exceeded	No return, connection closed

The behavior of the AE on receiving an Association abort is summarized in the next table.

Table 10: Association Abort Handling

Source	Reason/Diagnosis	Behavior
0 - DICOM UL service-user (initiated abort)	0 - reason-not-specified	The connection is closed
2 - DICOM UL service-provider (initiated abort)	0 - reason-not-specified	The connection is closed
	1 - unrecognized-PDU	The connection is closed
	2 - unexpected-PDU	The connection is closed
	4 - unrecognized-PDU-parameter	The connection is closed
	5 - unexpected-PDU-parameter	The connection is closed
	6 - invalid-PDU-parameter-value	The connection is closed

Table 11: DICOM Association Abort Policies

Source	Reason/Diagnosis	Behavior
0 - DICOM UL service-user	0 - reason-not-specified	When the system tries to disconnect before receiving an association accept but after sending association request; When receiving association accept with no presentation context item; When receiving association accept where all items in the presentation context item list are not accepted by remote system; When an association timeout (configurable per remote device) expired (timeout which determines how long to keep an idle association); When receiving a PDU whose size is bigger then the agreed max PDU size.
2 - DICOM UL service-provider	1- unrecognized-PDU	Whenever the system receives unexpected or unrecognized PDU (according to the DICOM UPPER LAYER PROTOCOL STATE TRANSITION TABLE in chapter 8 of the DICOM standard).
Other	Other	Not applicable.

4.2.1.3.1. (Real-World) Activity – Modality worklist As SCU

4.2.1.3.1.1. Description and Sequencing of Activities

The figure below shows a typical sequence for a worklist request from a Modality.

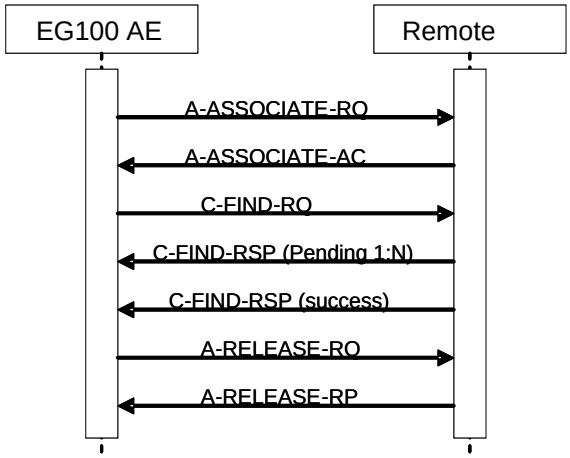

Figure 3: (Real World) Activity - Modality Worklist as SCU

ECG Gateway EG100 initiates an association when the user requests a DICOM Modality worklist.

4.2.1.3.1.2. Proposed Presentation Contexts

Each time an association is initiated, the association initiator proposes a number of presentation contexts to be used on that association. The association will be closed immediately upon receiving the response.

The presentation contexts proposed by EG100 for (Real-World) Activity – Modality Worklist are defined in the following table.

Table 12: Proposed Presentation Contexts for (Real-World) Activity – Modality worklist As SCU

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	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.3.1.3. SOP Specific Conformance for Modality Worklist Information Model - FIND SOP Class

This section includes the SOP specific behavior, i.e. error codes, error and exception handling, time-outs, etc.
Behavior of an Application Entity SOP class is summarized as shown in next Table. The standard as well as the manufacturer specific status codes and their corresponding behavior are specified.

4.2.1.3.1.3.1. Dataset Specific Conformance for Modality Worklist Information Model - FIND SOP Class C-FIND-SCU

This section includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

The table below should be read as follows:
Attribute Name: Attributes supported to build a Modality Worklist Request Identifier.
Tag: DICOM tag for this attribute.
VR: DICOM VR for this attribute.
M: Matching Keys for (automatic) Worklist Update.
R: Return Keys. An “X” will indicate that this attribute can be used as Matching Key for Universal Matching.
Q: Interactive Query Key. An “X” will indicate that this attribute as matching key can be used.
D: Displayed Keys. An “X” indicates that this Worklist attribute is displayed to the user during a patient registration dialog.
IOD: An “X” indicates that the value of this Worklist attribute will be used in the created Instances of this Performed Procedure Step.
Type of matching: The following types of matching exist:
Single Value Matching
Wild Card Matching
Universal Matching
Detail regarding the Dataset Specific response behavior will be reported in this section.

Table 13: Modality Worklist Optional Return keys supported

Attribute Name	Tag	VR	M	R	Q	D	IOD	Type of Matching	Comment
SOP Common Module									
Specific Character Set	0008,0005	CS							To be confirmed
Patient Identification Module									
Patient's Name	0010,0010	PN	X	X	X	X		Single Value,Universal, WildCard	
Patient ID	0010,0020	LO	X	X	X	X		Single Value,Universal	

Attribute Name	Tag	VR	M	R	Q	D	IOD	Type of Matching	Comment
Other Patient IDs	0010,1000	LO		X					
Patient Demographic Module									
Patient's Birth Date	0010,0030	DA	X	X	X	X		Single Value,Universal	
Patient's Birth Time	0010,0032	TM		X					
Patient's Sex	0010,0040	CS		X		X			
Patient's Age	0010,1010	AS							
Patient's Size	0010,1020	DS		X					
Patient's Weight	0010,1030	DS		X					
Ethnic Group	0010,2160	SH		X					
Visit Status Module									
Current Patient Location	0038,0300	LO		X					
Visit Identification Module									
Institution Name	0008,0080	LO		X					
Institutional Department Name	0008,1040	LO		X					
Scheduled Procedure Step Module									
Scheduled Procedure Step Sequence	0040,0100	SQ		X					
>Scheduled Procedure Step Start Date	0040,0002	DA	X	X		X		Single Value,Universal	
>Scheduled Procedure Step Start Time	0040,0003	TM		X		X			
>Scheduled Procedure Step Location	0040,0011	SH		X		X			
>Scheduled Procedure Step Status	0040,0020	CS		X		X			
Requested Procedure Module									
Study Instance UID	0020,000D	UI		X					
Requested Procedure Priority	0040,1003	SH		X		X			
Requested Procedure Comments	0040,1400	LT		X					
Imaging Service Request Module									
Accession Number	0008,0050	SH	X	X	X	X		Single Value,Universal	
Referring Physician's Name	0008,0090	PN		X					
Requesting Physician	0032,1032	PN		X					

This part of the section includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 14: C-FIND-RQ Status Responses

Service Status	Code	Further Meaning	Behavior
Success	0000	Matching is complete	The worklist is updated.
Failure	A700	Refused – Out of resources	The association is released. The reason is logged.
	A900	Failed – Identifier does not match SOP class	The association is released. The reason is logged.
	Cxxx	Failed – Unable to process	The association is released. The reason is logged.
Cancel	FE00	Matching terminated due to Cancel request	The association is released. The reason is logged.
Pending	FF00	Matches are continuing – Current match is supplied and any optional keys were supported in the same manner as required keys	The Query Worklist job continues.
	FF01	Matches are continuing – Warning that one or more optional keys were not supported for existence and/or matching for this identifier	The Query Worklist job continues.

Table 15: DICOM Communication Failure Behavior

Exception	Behavior
RIS query timeout (default 60 seconds)	The Association is aborted using A-ABORT and command marked as failed. The reason is logged and reported to the user.
Association aborted	The command is marked as failed. The reason is logged and reported to the user.

4.3. Network Interfaces

4.3.1. Physical Network Interfaces

The System provides only DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8 of the standard.
TCP/IP is the only protocol stack supported.
Supported physical medium include:
IEEE 802.3-1995, 10BASE-T
IEEE 802.3-1995, 100BASE-TX (Fast Ethernet)
IEEE 802.3, 1000BASE-X (Fiber Optic Gigabit Ethernet).

The TCP/IP Stack as supported by the underlying Operating System.
The API is the WinSock 2 interface as supported by the underlying Operating System.

4.3.2. Additional Protocols

Not applicable

4.4. Configuration

Any implementation's DICOM conformance may be dependent upon configuration, which takes place at the time of installation. Issues concerning configuration are addressed in this section.

4.4.1. AE Title/Presentation Address Mapping

An important installation issue is the translation from AE title to presentation address. How this is to be performed is described here.

4.4.1.1. Local AE Titles

The local AE title mapping and configuration are specified as:

Table 16: AE Title configuration table

Application Entity	Default AE Title	Default TCP/IP Port
ECG GATEWAY EG100	SCU1	104

4.4.1.2. Remote AE Title/Presentation Address Mapping

The configuration of the remote application is specified here.

4.4.2. Parameters

The specification of important operational parameters, their default value and range (if configurable) are specified here.

Table 17: Configuration Parameters Table

Parameter	Configurable	Default Value
General Parameter		
DICOM Port	Yes	104
Log IP Address	Yes	127.0.0.1
AE Specific Parameters		
AE Title (AET)	Yes	
Modality	Yes	False

5. Media Interchange

Not applicable

6. Support of Character Sets

Any support for character sets in Network and Media services is described here.

Table 18: Supported DICOM Character Sets

Character Set Description	Defined Term	ESC Sequence	ISO Registration Number	Code Element	Character Set
Latin alphabet No. 1	ISO_IR 6	-	ISO-IR 6	G0	ISO 646

7. Security

Not applicable