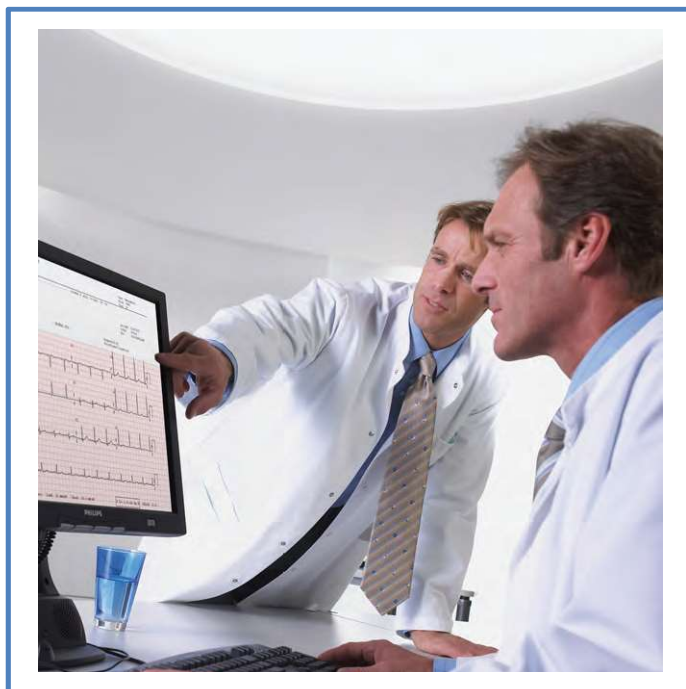


DICOM Conformance Statement

IntelliSpace ECG DICOM Gateway B.02



Issued by:

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1. DICOM Conformance Statement Overview

This document is the DICOM Conformance Statement for the IntelliSpace ECG Dicom Gateway B.02

The IntelliSpace DICOM Gateway provides the standards-based approach to integrating diagnostic ECG waveforms into the hospital enterprise.

It is comprised of an installed windows service and a web-based application for configuration. It is s built on top of the MS.Net platform with a SQL Server database serving as the backend repository.

The DICOM Gateway can be deployed in several modes:

- provide select modification of DICOM export functionality from select Philips modalities
- provide conversion of Philips XML ECG files to standard DICOM formats

The DICOM Gateway is also embedded within the standard ISECG where it provides the ability to accept DICOM-formatted ECGs from compliant devices and the ability to export records in DICOM format

It provides, among other things, the following DICOM services:

- Import of DICOM objects
- Export of DICOM objects
- Storage Commitment
- Functions as bridge for MWL & MPPS requests and responses from a remote DICOM node.

The following table provides an overview of all network services as provided by the ISECG DICOM Gateway.

Table 1: Network Services

SOP Class		User of Service (SCU)	Provider of Service (SCP)	Display
Name	UID			
Transfer				
12-Lead ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes	Yes
General ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes**	Yes
Workflow Management				
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes	No
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes*	Yes*	No
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.31	Yes*	Yes*	No
Verification SOP Class	1.2.840.10008.1.1	No	Yes	No

*Only forwarding is supported

** Encapsulated PDF can be viewed only on Microsoft Edge or Google Chrome.

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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	Description of change
1.0	13-JULY-2021	Draft 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 responsibility of the user (or user's agent) 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 ensure 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).

3.4. Definitions, Terms and Abbreviations

Table 3: Definitions, Terms and Abbreviations

Abbreviation/Term	Explanation
AE	Application Entity
ANSI	American National Standard Institute
BOT	Basic Offset Table
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DIMSE-Composite
DIMSE-N	DIMSE-Normalized
ILE	DICOM Implicit VR Little Endian
IOD	Information Object Definition
MWL	Modality Worklist
MPPS	Modality Performed Procedure Step
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
RWA	Real-World Activity
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

3.5. References

[DICOM] Digital Imaging and Communications in Medicine, Parts 1 - 22 (NEMA PS 3.1- PS 3.22),
 National Electrical Manufacturers Association
 1300 North 17th Street
 Suite 900
 Arlington, Virginia 22209
 Internet: <https://www.dicomstandard.org/current>

Note that at any point in time the official standard consists of the most recent yearly edition of the base standard (currently 2021) plus all the supplements and correction items that have been approved as Final Text.

4. Networking

This section contains the networking related services (vs. the media related ones).

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 ISECG DICOM Gateway system consists of one single application entity, the ISECG DICOM Proxy Entity ISECG DICOM Gateway AE.

The figure below shows the networking application data flow as a functional overview of the ISECG DICOM Gateway AE. On the left the local Real-World Activities are presented, whereas on the right the remote Real-World Activities are presented.

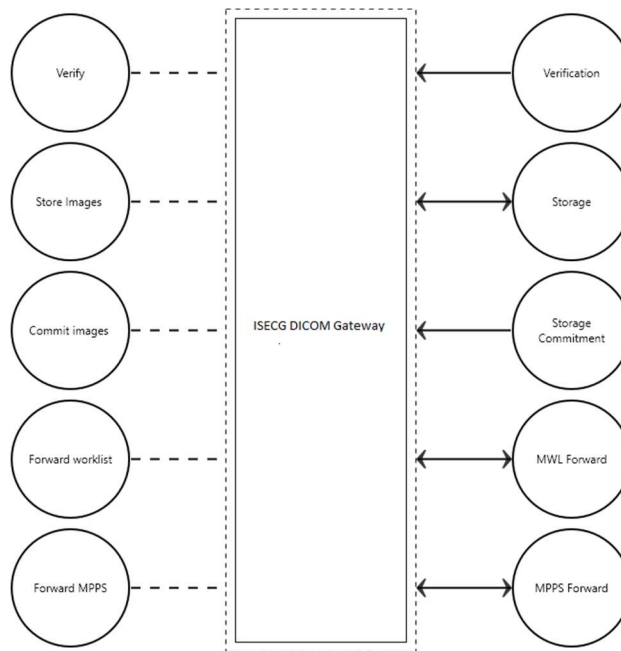


Figure 1: Application Data Flow Diagram

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 ISECG DICOM Gateway AE

The ISECG DICOM Gateway AE is the only application entity within ISECG. It includes the following DICOM functionality.

- Import (STORE SCP) DICOM objects (ECG Waveforms and Encapsulated PDF) to a local database.
- Storage Commitment (SCP) from a remote DICOM system in synchronous and asynchronous modes.
- Export (STORE SCU) DICOM objects (ECG Waveforms and Encapsulated PDF) from the local database to a network DICOM node.
- MWL and MPPS: forward requests and responses from a remote DICOM node and to another DICOM remote node.

4.1.3. Sequencing of Real World Activities

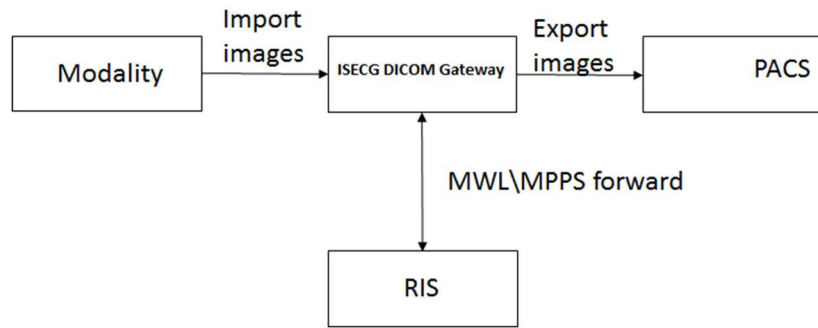


Figure 2: Sequence of Real World Activities

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. ISECG DICOM Gateway AE

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 2: SOP Classes for Storage Application Entity

SOP Class Name	SOP Class UID	SCU	SCP
12-Lead ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
General ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	No	Yes
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.31	Yes*	Yes*
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes*	Yes*
Verification SOP Class	1.2.840.10008.1.1	No	Yes

*only forwarding as a proxy.

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

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4.2.1.2.2. Number of Associations

The number of simultaneous associations that an Application Entity may support as an 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	Dynamic (depends on system resource)

Table 7: Number of associations as an Association Acceptor for this AE

Description	Value
Maximum number of simultaneous associations	Dynamic (depends on system resource)

4.2.1.2.3. Asynchronous Nature

The implementation supports negotiation of multiple outstanding transactions, along with the maximum number of outstanding transactions supported.

Table 8: Asynchronous nature as an Association Initiator for this AE

Description	Value
Maximum number of outstanding asynchronous transactions	Dynamic (depends on system resource)

4.2.1.2.4. Implementation Identifying Information

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

Table 9: DICOM Implementation Class and Version for ISECG DICOM Gateway AE

Implementation Class UID	1.3.46.670589.32.860426.11.2
Implementation Version Name	ISECG B02

4.2.1.2.5. Communication Failure Handling

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

Table 10: Communication Failure Behavior

Exception	Behavior
ARTIM Timeout	The association is released and the connection is closed.
Association aborted	The association is released and the connection is closed.

4.2.1.3. Association Initiation Policy

The behavior of this Application Entity is summarized in the next Table.

Table 11: Association Rejection Response

Result	Source	Reason/Diagnosis	Behavior
1 - rejected-permanent	1 - DICOM UL service-user	1 - no-reason-given	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=1 - rejected-permanent source=1 - service-user reason=1 - no-reason-given
		2 - application-context-name-not-supported	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=1 - rejected-permanent source=1 - service-user reason=2 - application-context-name-not-supported
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	Association is not established. The following error is logged. result=1 - rejected-permanent source=2 - service-user(ACSE) reason=1 - no-reason-given
		2 - protocol-version-not-supported	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=1 - rejected-permanent source=2 - service-provider (ACSE) reason=2 - protocol-version-not-supported
	3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=1 - rejected-permanent source=3 - service-provider (Presentation) reason=1 - temporary-congestion
		2 - local-limit-exceeded	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=1 - rejected-permanent source=3 - service-provider (Presentation) reason=2 - local-limit-exceeded
2 - rejected-transient	1 - DICOM UL service-user	1 - no-reason-given	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=1 - service-user reason=1 - no-reason-given
		2 - application-context-name-not-supported	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=1 - service-user reason=2 - application-context-name-not-supported

Result	Source	Reason/Diagnosis	Behavior
	2 - DICOM UL service-provider (ACSE related function)	1 - no-reason-given	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=2 - service-provider (ACSE) reason=1 - no-reason-given
		2 - protocol-version-not-supported	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=2 - service-provider (ACSE) reason=2 - protocol-version-not-supported
	3 - DICOM UL service-provider (Presentation related function)	1 - temporary-congestion	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=3 - service-provider (Presentation) reason=1 - temporary-congestion
		2 - local-limit-exceeded	Association is not established. The following error is logged. A-ASSOCIATE-RJ result=2 - rejected-transient source=3 - service-provider (Presentation) reason=2 - local-limit-exceeded

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

Table 3: Association Abort Handling

Source	Reason/Diagnosis	Behavior
0 - DICOM UL service-user (initiated abort)	0- reason-not-specified	Return response, stop processing.
2 - DICOM UL service-provider (initiated abort)	0 - reason-not-specified	Return response, stop processing.
	1 - unrecognized-PDU	Return response, stop processing.
	2 - unexpected-PDU	Return response, stop processing.
	4 - unrecognized-PDU-parameter	Return response, stop processing.
	5 - unexpected-PDU-parameter	Return response, stop processing.
	6 - invalid-PDU-parameter-value	Return response, stop processing.

Notes:

- Associate PDU items that are recognized:
 - 0x10 APPLICATION CONTEXT
 - 0x20 PRESENTATION CONTEXT (RQ)
 - 0x21 PRESENTATION CONTEXT (AC)
 - 0x30 ABSTRACT SYNTAX
 - 0x40 TRANSFER SYNTAX
 - 0x50 USER INFO
 - 0x51 MAXIMUM LENGTH
 - 0x52 IMPLEMENTATION CLASS UID
 - 0x53 ASYNCHRONOUS OPERATIONS WINDOW
 - 0x54 SCP/SCU ROLE SELECTION
 - 0x55 IMPLEMENTATION VERSION NAME
 - 0x56 SOP CLASS EXTENDED NEGOTIATION

2. Associate PDU items for Unexpected-PDU parameter Received more than once:

- 0x10 APPLICATION CONTEXT (SCU, SCP)
- 0x30 ABSTRACT SYNTAX (SCU, SCP)
- 0x40 TRANSFER SYNTAX (SCU)

Received unexpectedly:

- 0x20 PRESENTATION CONTEXT (RQ) (SCU)

3. Associate PDU items for Invalid-PDU parameter value:

Received more than once (SCU, SCP):

- 0x50 USER INFO
- 0x51 MAXIMUM LENGTH
- 0x52 IMPLEMENTATION CLASS UID
- 0x53 ASYNCHRONOUS OPERATIONS WINDOW
- 0x55 IMPLEMENTATION VERSION NAME

Received illegally:

- 0x21 PRESENTATION CONTEXT (AC) (SCP)

PDU items not received:

- 0x10 APPLICATION CONTEXT (SCU, SCP)
- 0x20 PRESENTATION CONTEXT (RQ) (SCP)
- 0x21 PRESENTATION CONTEXT (AC) (SCU)
- 0x50 USER INFO (SCU, SCP)
- 0x30 ABSTRACT SYNTAX (SCU)
- 0x40 TRANSFER SYNTAX (SCU)
- 0x51 MAXIMUM LENGTH (SCU, SCP)
- 0x52 IMPLEMENTATION CLASS UID (SCU)

4. PDU types that are recognized:

- 0x01 A-ASSOCIATE-RQ
- 0x02 A-ASSOCIATE-AC
- 0x03 A-ASSOCIATE-RJ
- 0x04 P-DATA-TF
- 0x05 A-RELEASE-RQ
- 0x06 A-RELEASE-RP
- 0x07 A-ABORT

5. Expected PDU's for following states:

STATE_IDLE:

- 0x01 A-ASSOCIATE-RQ
- 0x02 A-ASSOCIATE-AC
- 0x03 A-ASSOCIATE-RJ
- 0x05 A-RELEASE-RQ
- 0x06 A-RELEASE-RP

STATE_ASSOCIATED:

- 0x01 A-ASSOCIATE-RQ
- 0x02 A-ASSOCIATE-AC
- 0x03 A-ASSOCIATE-RJ
- 0x06 A-RELEASE-RP

STATE_ASSOCIATING (SCU):

- 0x01 A-ASSOCIATE-RQ
- 0x04 P-DATA-TF
- 0x05 A-RELEASE-RQ
- 0x06 A-RELEASE-RP

STATE_RELEASING:

- 0x01 A-ASSOCIATE-RQ
- 0x02 A-ASSOCIATE-AC
- 0x03 A-ASSOCIATE-RJ

STATE_WAIT_FOR_ASSOCIATE (SCP):

- 0x02 A-ASSOCIATE-AC
- 0x03 A-ASSOCIATE-RJ
- 0x04 P-DATA-TF

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- 0x05 A-RELEASE-RQ
 - 0x06 A-RELEASE-RP
 - 0x07 A-ABORT
- STATE_WAIT_FOR_FINISH:
- 0x01 A-ASSOCIATE-RQ
 - 0x02 A-ASSOCIATE-AC
 - 0x03 A-ASSOCIATE-RJ
 - 0x04 P-DATA-TF
 - 0x05 A-RELEASE-RQ
 - 0x06 A-RELEASE-RP
- STATE_WAIT_FOR_DISCONNECT:
- 0x01 A-ASSOCIATE-RQ
 - 0x02 A-ASSOCIATE-AC
 - 0x03 A-ASSOCIATE-RJ
- STATE_TIMED_OUT:
- 0x01 A-ASSOCIATE-RQ
 - 0x02 A-ASSOCIATE-AC
 - 0x03 A-ASSOCIATE-RJ
 - 0x04 P-DATA-TF
 - 0x05 A-RELEASE-RQ
 - 0x06 A-RELEASE-RP
 - 0x07 A-ABORT

Table 4: DICOM Command Communication Failure Behavior

Source	Reason/Diagnosis	Behavior
Reply Timeout	Timeout	N/A
Association aborted	Association aborted	The command is marked as failed. The reason is logged and reported to the user.

4.2.1.3.1. (Real-World) Activity – Image Export

4.2.1.3.1.1. Description and Sequencing of Activities

The ISECG DICOM Gateway implements the Storage service class to store selected images at an archive or other storage SCP

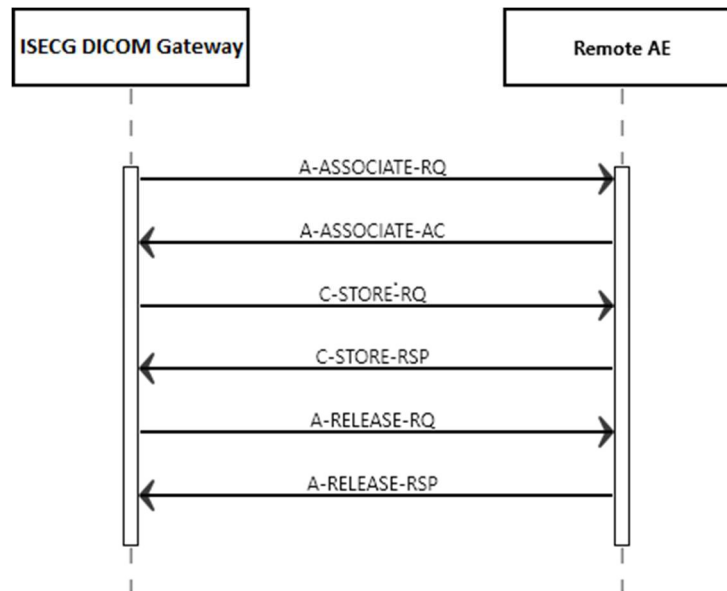


Figure 3: Data Flow Diagram – Image export

4.2.1.3.1.2. Proposed Presentation Contexts

The presentation contexts are defined in the next table.

Table 14: Proposed Presentation Contexts for (Real-World) Activity – Image Export

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
12-Lead ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
General ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Encapsulated PDF Storage SOP Class	1.2.840.10008.5.1.4.1.1.104.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

Note: Implicit VR Little Endian is preferred transfer syntax. For Explicit VR Little Endian, it needs to be configured.

4.2.1.3.1.3. SOP Specific Conformance for verification SOP Class

ISECG DICOM Gateway sends the DICOM messages to the configured DICOM systems

4.2.1.3.1.3.1. Dataset Specific Conformance for C-STORE-RQ

Detail regarding the Dataset Specific response behavior will be reported in this section.

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

Table 15: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successfully stored	Store operation is successful.
Failure	A700	Refused: Out of Resources	Store operation is unsuccessful. Write error log.
	A900	Error: Data Set does not match SOP Class	Store operation is unsuccessful. Write error log.
	C000	Error: Cannot understand	Store operation is unsuccessful. Write error log.
Warning	0111	Duplicate SOP Instance	Store operation is unsuccessful. Write error log.
	B000	Coercion of Data Elements	Store operation is unsuccessful. Write error log.
	B006	Elements Discarded	Store operation is unsuccessful. Write error log.
	B007	Data Set does not match SOP Class	Store operation is unsuccessful. Write error log.

Note: When forwarding MWL and MPPS messages, the ISECG DICOM Gateway AE will add Group Length elements to the messages

4.2.1.3.2. (Real-World) Activity – Modality Worklist as SCU

4.2.1.3.2.1. Description and Sequencing of Activities

IntelliSpace ECG DICOM Gateway system can be configured to forward MWL to a configured Forward MWL node. When MWL messages are received from a modality (SCU node), the messages are forwarded same as that received from the SCU node. The ISECG DICOM Gateway system is capable of forwarding the MWL requests from a remote node to another remote node. The system is not capable of creating attributes for C-FIND-RQ.

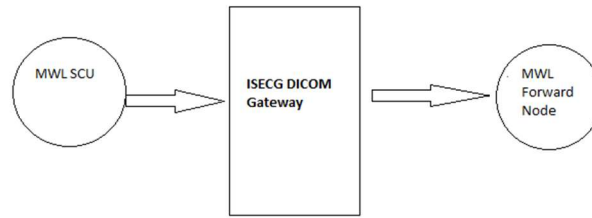


Figure 4: Modality Worklist as SCU

4.2.1.3.3. (Real-World) Activity - Modality Performed Procedure Step as SCU

4.2.1.3.3.1. Description and Sequencing of Activities

IntelliSpace ECG DICOM Gateway system can be configured to forward MPPS to a configured Forward MPPS node. When MPPS messages are received from a modality, the messages are forwarded as such to the forward MPPS node. The MPPS Information model is same as that received from the SCU node.

The ISECG DICOM Gateway system is capable of forwarding the MPPS requests from a remote node to another remote node. The system is not capable of creating attributes for N-CREATE-RQ.

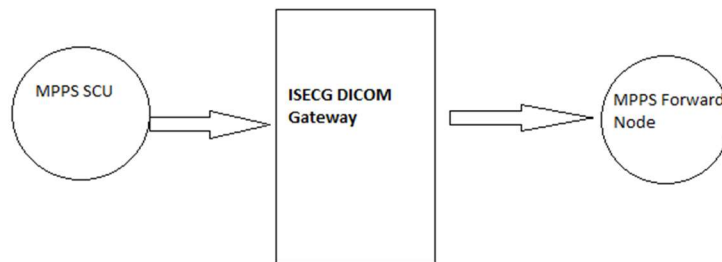


Figure 5: Modality Performed Procedure Step as SCU

4.2.1.3.3.1.1.1. Dataset Specific Conformance for Storage Commitment Push Model SOP Class N-EVENT-REPORT-SCU

Table 55: Storage Commitment N-EVENT-REPORT Behavior.

Event Type Name	Event Type	Behavior
Storage Commitment Request Successful	1	Store operation is successful.
Storage Commitment Request Complete - Failures Exist	2	Store operation failed. Return a response which contain Failed SOP Sequence

Table 66: Storage Commitment N-EVENT-REPORT Failure Handling Behavior

Service Status	Error Code	Further Meaning	Description
Success	0000	Success	Return the result of Store operation N-EVENT-REPORT always return Success. If Failures Exist, Failed SOP Sequence will be include in the DICOM response dataset

4.2.1.4. Association Acceptance Policy

4.2.1.4.1. (Real-World) Activity – Modality Worklist as SCP

The ISECG DICOM Gateway system is capable of forwarding the MWL responses from a remote node to another remote node and vice versa.

4.2.1.4.1.1. Proposed Presentation Contexts

The presentation contexts are defined in the next table.

Table 7: Proposed Presentation Contexts for (Real-World) Activity – Modality Worklist

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU\SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.2. (Real-World) Activity - Modality Performed Procedure Step as SCP

The ISECG DICOM Gateway system is capable of forwarding the MPPS requests from a remote node to another remote node.

4.2.1.4.2.1. Proposed Presentation Contexts

The presentation contexts are defined in the next table.

Table 8: Proposed Presentation Contexts for (Real-World) Activity – Modality Performed Procedure Step

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU\SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.3. (Real-World) Activity – Verification as SCP

4.2.1.4.3.1. Description and Sequencing of Activities

A remote system requests verification from ISECG DICOM Gateway AE using the C-ECHO command.

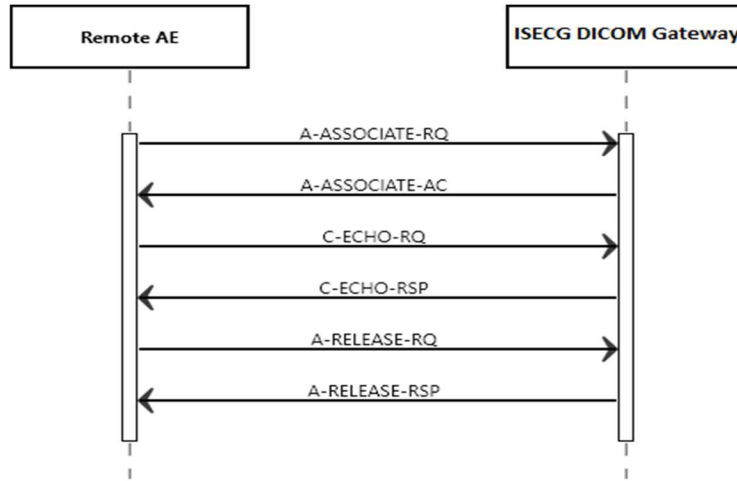


Figure 6: (Real World) Activity - Verification as SCP

4.2.1.4.3.2. Accepted Presentation Contexts

The presentation contexts are defined in the next table.

Table 9: Accepted Presentation Contexts for (Real-World) Activity – Verification as SCP

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	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.3.3. SOP Specific Conformance for Verification SOP Class

ISECG DICOM Gateway AE (C-ECHO SCP) provides standard conformance to the DICOM V3.0 verification SOP Class.

4.2.1.4.3.3.1. Dataset Specific Conformance for Verification C-ECHO SCP

Detail regarding the Dataset Specific response behavior will be reported in this section. This includes the dataset specific behavior, i.e. error codes, error and exception handling, time-outs, etc.

Table 10: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Success	C-ECHO command was successful received.

4.2.1.4.4. (Real-World) Activity – Image Import

4.2.1.4.4.1. Description and Sequencing of Activities

The ISECG DICOM Gateway accept associations from configured systems that wish to store images in its database using the C-STORE command.

Note – Data imported by ISECG DICOM Gateway is converted from DICOM format and stored in a proprietary format.

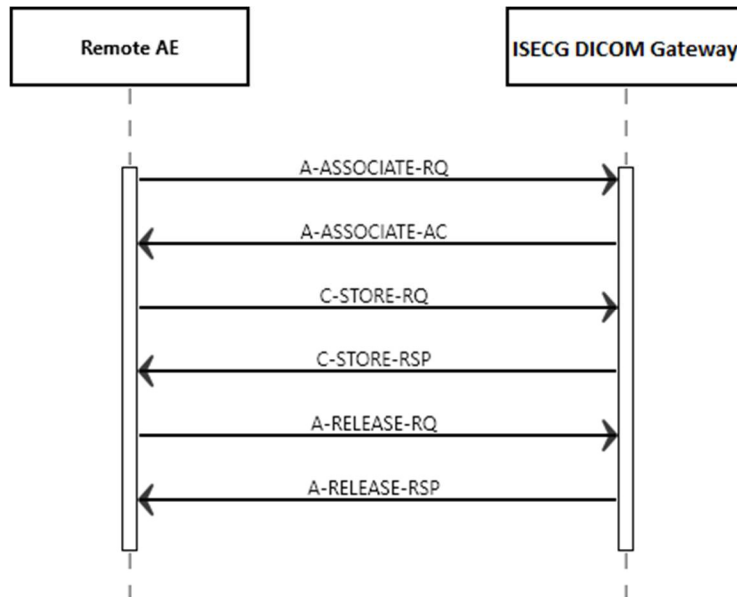


Figure 7: Data Flow Diagram – Store Image – Storage as SCP

Table 11: Accepted Presentation Contexts for (Real-World) Activity – Image Import

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
12-Lead ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
General ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		
Encapsulated PDF Storage SOP Class	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

Notes:

- When imported patient name with five components, ISECG DICOM Gateway system truncates to three components (last name, middle name and first name).
- For 12 Lead ECG Waveform Storage SOP Class and General Waveform ECG SOP Class the Sampling Frequency (003A, 001A) shall have a value of 500.
- For 12 Lead ECG Waveform Storage SOP Class and General Waveform ECG SOP Class the Number of Waveform Samples (003A,0010) shall have a value in the range of 5000 to 5500.

4.2.1.4.4.2. SOP Specific Conformance for Storage SOP Classes

ISECG DICOM Gateway receives the incoming DICOM messages from configured DICOM systems and store it in the local database.

4.2.1.4.4.2.1. Dataset Specific Conformance for C-STORE-RSP

Details regarding the Dataset Specific response behavior will be reported in this section.

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

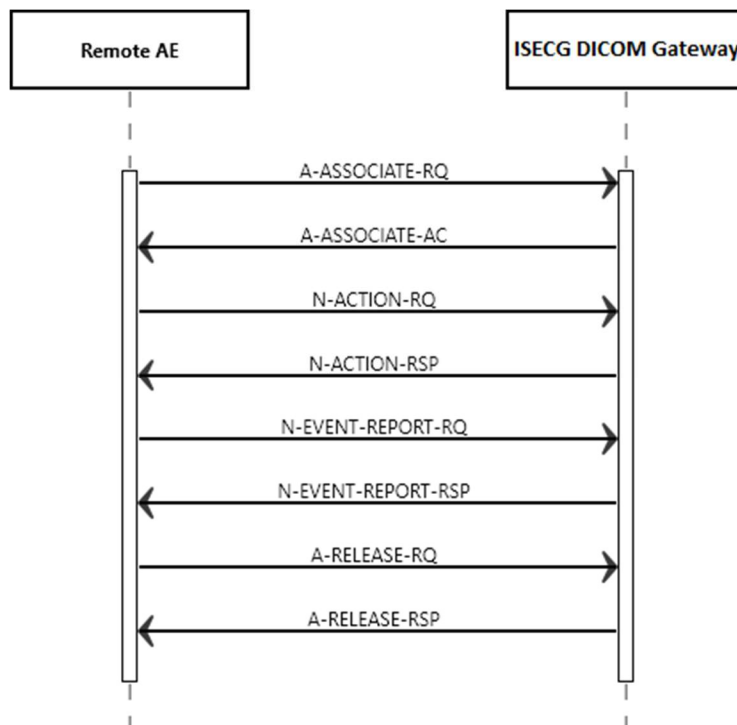
Table 12: Status Response C-STORE

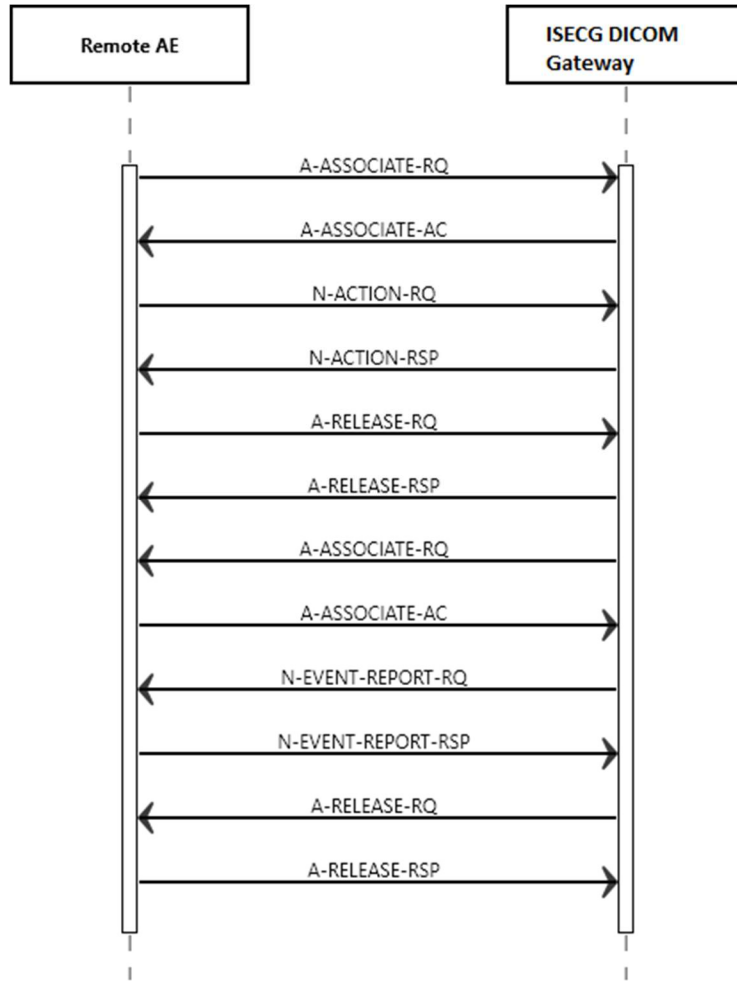
Service Status	Error Code	Further Meaning	Behavior
Success	0000	Successfully stored	Store operation is successful.
Failure	A700	Refused: Out of Resources	Store operation is unsuccessful. Write error log.
	A900	Error: Data Set does not match SOP Class	Store operation is unsuccessful. Write error log.
	C000	Error: Cannot understand	Store operation is unsuccessful. Write error log.
	0111	Duplicate SOP Instance	Store operation is unsuccessful. Write error log.
Warning	B000	Coercion of Data Elements	Store operation is unsuccessful. Write error log.
	B006	Elements Discarded	Store operation is unsuccessful. Write error log.
	B007	Data Set does not match SOP Class	Store operation is unsuccessful. Write error log.

4.2.1.4.5. (Real-World) Activity - Storage Commitment Push Model as SCP

4.2.1.4.5.1. Description and Sequencing of Activities

The IntelliSpace ECG DICOM Gateway supports synchronous and asynchronous mode for storage commitment SCP.





4.2.1.4.5.2. Accepted Presentation Contexts

Table 22: Accepted Presentation Contexts for Storage Commitment Push Model as SCP

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.5.3. SOP Specific Conformance for SOP Classes

The associated Activity with the Storage Commitment Push Model service is the communication by the STORAGE-SCP AE to peer AEs that it has committed to permanently store Composite SOP Instances that have been sent to it. It thus allows peer AEs to determine whether the IntelliSpace ECG Server has taken responsibility for the archiving of specific SOP Instances so that they can be flushed from the peer AE system.

The STORAGE-SCP AE takes the list of Composite SOP Instance UIDs specified in a Storage Commitment Push Model N-ACTION Request and checks if they are present in the IntelliSpace ECG DICOM Server application database. As long as the Composite SOP Instance UIDs are present in the database, the STORAGE-SCP AE will consider those Composite SOP Instance UIDs to be successfully archived. The STORAGE-SCP AE does not require the Composite SOP Instances to actually be successfully written to archive media in order to commit to responsibility for maintaining these SOP Instances.

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Once the STORAGE-SCP AE has checked for the existence of the specified Composite SOP Instances, it will then attempt to send the Notification request (N-EVENT-REPORT-RQ). The default behavior is to attempt to send this Notification over the same Association that was used by the peer AE to send the original N-ACTION Request. If the Association has already been released or Message transfer fails for some reason then the STORAGE-SCP AE will attempt to send the N-EVENT-REPORT-RQ over a new Association. The STORAGE-SCP AE will request a new Association with the peer AE that made the original N-ACTION Request. The STORAGE-SCP AE can be configured to always open a new Association in order to send the Notification request.

- 4.2.1.4.5.3.1. **SOP Specific Conformance for Storage Commitment Push Model SOP Class**
- 4.2.1.4.5.3.2. **Dataset Specific Conformance for Storage Commitment Push Model SOP Class N-ACTION-SCP**

Synchronous and Asynchronous store commitment are supported

Table 23: N-ACTION-RSP Dataset Specification.

Storage Commitment Push Model SOP Class			
Attribute Name	Tag	VR	Comment
Storage Commitment Request - Action Information Module			
Transaction UID	0008,1195	UI	Transaction UID
Referenced SOP Sequence	0008,1199	SQ	Referenced SOP Sequence (if success)
>Referenced SOP Class UID	0008,1150	UI	Referenced SOP Class UID
>Referenced SOP Instance UID	0008,1155	UI	Referenced SOP Instance UID
Failed SOP Sequence	0008,1198	SQ	Failed SOP Sequence (if fail)
>Referenced SOP Class UID	0008,1150	UI	Referenced SOP Class UID
>Referenced SOP Instance UID	0008,1155	UI	Referenced SOP Instance UID
>Failure Reason	0008,1197	US	Failure Reason

Table 134: Status Response

Service Status	Error Code	Further Meaning	Behavior
Success	0000	Success	Request has been accepted, and will be processed

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

4.3.3. IPv4 and IPv6 Support

The IntelliSpace ECG B.02 supports IPv4 networks communication

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 27: AE Title configuration table

Application Entity	Default AE Title	Default TCP/IP Port
ISECG DICOM Gateway AE	DICOMPROXY	9104 (Store) 9105(Storage commitment) 9107(MWL) 9108(MPPS)

4.4.1.2. Remote AE Title/Presentation Address Mapping

Remote AE Title, IP-Address, Port-number, supported DICOM Services and supported Transfer Syntaxes are freely configurable.

4.4.2. Parameters

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

Table 28: Configuration Parameters Table

Parameter	Configurable	Default Value
General Parameter		
Time-out waiting for acceptance or rejection Response to an Association Open Request (Application Level timeout)	No	N/A
General DIMSE level time-out values (Verification, Storage, Storage Commitment)	No	N/A
Time-out for response to TCP/IP connect request. (Low-level timeout)	No	N/A
Time-out waiting for acceptance of a TCP/IP message over the network (Low-level timeout)	No	N/A
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	No	N/A
Any changes to default TCP/IP settings, such as configurable stack parameters.	No	N/A
Local AE Specific Parameters		
Size constraint in maximum object size	No	N/A
Maximum PDU size the AE can send and receive	No	16352
Association time-out SCP	No	N/A
Association time-out SCU	No	N/A
AE specific DIMSE level time-out values	No	N/A
Number of simultaneous associations by service and/or SOP class	No	Dynamic
SOP Class support	No	Check Table 5

Parameter	Configurable	Default Value
Transfer Syntax support	No	Implicit VR Little Endian
Remote Configurable Parameters		
Device Type	No	N/A
DICOM services supported by PACS AE	No	N/A
Data Type supported by Archive node	No	N/A
Association (Artim) time-out	No	5 seconds
Storage Commit Max Reply Waiting Time (after time-out the reply will be handled asynchronously)	No	N/A
Number of simultaneous associations by service and/or SOP class	No	Dynamic
SOP Class support	No	Check Table 5
Transfer Syntax support	Yes	Implicit VR Little Endian

5. Media Interchange

5.1. Implementation model

Not Applicable

5.2. AE Specifications

Not Applicable

5.3. Augmented and Private Application Profiles

Not Applicable

5.4. Media Configuration

Not Applicable

6. Support of Character Sets

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

Table 29: Supported DICOM Character Sets

Character Set Description	Defined Term	ESC Sequence	ISO Registration Number	Code Element	Character Set
Latin alphabet No. 1	ISO_IR 100	-	ISO-IR 6	G0	ISO 646
		-	ISO-IR 100	G1	Supplementary set of ISO 8859

7. Security

7.1. Security Profiles

ISECG DICOM Gateway does not support any security profiles.

8. Annexes of application "ISECG DICOM Gateway"

8.1. IOD Contents

8.1.1. Created SOP Instance

This section specifies each IOD created by this application.

This section specifies each IOD created (including private IOD's). It should specify the attribute name, tag, VR, and value. The value should specify the range and source (e.g. user input, Modality Worklist, automatically generated, etc.). For content items in templates, the range and source of the concept name and concept values should be specified. Whether the value is always present or not shall be specified.

Abbreviations used in the IOD tables for the column "Presence of Module" are:

- ALWAYS The module is always present
- CONDITIONAL The module is used under specified condition

Abbreviations used in the Module table for the column "Presence of Value" are:

- ALWAYS The attribute is always present with a value
- EMPTY The attribute is always present without any value (attribute sent zero length)
- VNAP The attribute is always present and its Value is Not Always Present (attribute sent zero length if no value is present)
- ANAP The attribute is present under specified condition – if present then it will always have a value

The abbreviations used in the Module table for the column "Source" are:

- AUTO The attribute value is generated automatically
- CONFIG The attribute value source is a configurable parameter
- COPY The attribute value source is another SOP instance
- FIXED The attribute value is hard-coded in the application
- IMPLICIT The attribute value source is a user-implicit setting
- MPPS The attribute value is the same as that use for Modality Performed Procedure Step
- MWL The attribute value source is a Modality Worklist
- USER The attribute value source is explicit user input

Note:

ISECG DICOM Gateway does not generate new Objects. A copy of imported objects is created. For attributes with source 'COPY', the source instance is expected to contain the attribute, else the attribute will not be included in the created object.

8.1.1.1. List of created SOP Classes

Table 30: List of created SOP Classes

SOP Class Name	SOP Class UID
12-Lead ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.1
General ECG Waveform Storage SOP Class	1.2.840.10008.5.1.4.1.1.9.1.2
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1

8.1.1.2. 12-Lead ECG Waveform Storage SOP Class

Table 31: IOD of Created 12-Lead ECG Waveform Storage SOP Class Instances

Information Entity	Module	Presence Of Module
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS

	Patient Study Module	ALWAYS
Series	General Series Module	ALWAYS
Equipment	General Equipment Module	ALWAYS
Waveform	Acquisition Context Module	ALWAYS
	Waveform Identification Module	ALWAYS
	Waveform Module	ALWAYS
	Waveform Annotation Module	CONDITIONAL
	SOP Common Module	ALWAYS

Table 32: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		VNAP	COPY	
Patient ID	0010,0020	LO		VNAP	COPY	
Patient's Birth Date	0010,0030	DA		VNAP	COPY	
Patient's Sex	0010,0040	CS		VNAP	COPY	
Ethnic Group	0010,2160	SH		ANAP	COPY	

Table 33: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		VNAP	COPY	
Study Time	0008,0030	TM		VNAP	COPY	
Accession Number	0008,0050	SH		VNAP	COPY	
Referring Physician's Name	0008,0090	PN		VNAP	COPY	
Name of Physician(s) Reading Study	0008,1060	PN		ANAP	COPY	
Study Description	0008,1030	LO		ANAP	COPY	
Study Instance UID	0020,000D	UI		ALWAYS	AUTO	
Study ID	0020,0010	SH		VNAP	COPY	

Table 34: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Age	0010,1010	AS		VNAP	COPY	
Patient's Size	0010,1020	DS		VNAP	COPY	
Patient's Weight	0010,1030	DS		VNAP	COPY	
Admission ID	0038,0010	LO		ANAP	COPY	

Table 35: General Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Modality	0008,0060	CS	ECG	ALWAYS	FIXED	
Operators' Name	0008,1070	PN		ANAP	COPY	
Series Instance UID	0020,000E	UI		ALWAYS	AUTO	

Series Number	0020,0011	IS		VNAP	COPY	
Laterality	0020,0060	CS		ANAP	COPY	
Performed Protocol Code Sequence	0040,0260	SQ		ALWAYS	AUTO	
>Code Value	0008,0100	SH	P2-3120A	ANAP	AUTO	
>Coding Scheme Designator	0008,0102	SH	SRT	ANAP	AUTO	
>Code Meaning	0008,0104	LO	12-Lead ECG	ANAP	AUTO	

Table 36: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO	Philips	VNAP	FIXED	
Institution Name	0008,0080	LO		ANAP	COPY, USER	
Station Name	0008,1010	SH	StationName	ANAP	FIXED	
Institutional Department Name	0008,1040	LO		ANAP	USER	
Manufacturer's Model Name	0008,1090	LO	860426(ISECG DICOM Gateway)	ANAP	FIXED	
Device Serial Number	0018,1000	LO		ANAP	CONFIG	
Software Version(s)	0018,1020	LO	B.02.03	ANAP	FIXED	

Table 37: Acquisition Context Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Acquisition Context Sequence	0040,0555	SQ		VNAP	AUTO\COPY	
>Value Type	0040,A040	CS	CODE	VNAP	AUTO\COPY	
>Concept Name Code Sequence	0040,A043	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	5.4.5-33-1	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	Electrode Placement	ANAP	AUTO\COPY	
>Concept Code Sequence	0040,A168	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	5.4.5-33-1-1	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	Standard 12-Lead positions: limb leads placed at extremities	ANAP	AUTO\COPY	
>Measurement Units Code Sequence	0040,08EA	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	mmHg	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	UCUM	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH	1.4	ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	millimeters Hg	ANAP	AUTO\COPY	
>Value Type	0040,A040	CS	NUMERIC	VNAP	AUTO\COPY	
>Concept Name Code Sequence	0040,A043	SQ		ALWAYS	AUTO\COPY	

>>Code Value	0008,0100	SH	F-008EC(Systolic Blood Pressure)	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SRT	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH		ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	Systolic Blood Pressure	ANAP	AUTO\COPY	
>Numeric Value	0040,A30A	DS		VNAP	AUTO\COPY	This will be the systolic BP value.
>Concept Name Code Sequence	0040,A043	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	F-008ED	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SRT	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH		ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	Diastolic Blood Pressure	ANAP	AUTO\COPY	
>Numeric Value	0040,A30A	DS		VNAP		This will be the diastolic BP value.

Note: Specified values are applicable context of the ISECG DICOM Gateway workflow.

Table 38: Waveform Identification Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Content Date	0008,0023	DA		ALWAYS	AUTO\COPY	
Acquisition Datetime	0008,002A	DT		ALWAYS	AUTO\COPY	
Content Time	0008,0033	TM		ALWAYS	AUTO\COPY	
Instance Number	0020,0013	IS	1	ALWAYS	AUTO\COPY	

Table 39: Waveform Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Waveform Sequence	5400,0100	SQ		ALWAYS	AUTO\COPY	
> Multiplex Group Time Offset	0018,1068	DS		ALWAYS	AUTO\COPY	
>Trigger Time Offset	0018,1069	DS		ALWAYS	AUTO\COPY	
>Waveform Originality	003A,0004	CS		ALWAYS	AUTO\COPY	This will be "ORIGINAL" for the rhythm data and "DERIVED" for median data.
>Number of Waveform Channels	003A,0005	US		ALWAYS	AUTO\COPY	
>Number of Waveform Samples	003A,0010	UL		ALWAYS	AUTO\COPY	
>Sampling Frequency	003A,001A	DS		ALWAYS	AUTO\COPY	Frequency in Hz
>Multiplex Group Label	003A,0020	SH		ANAP	AUTO\COPY	This is "RHYTHM" for the first group and "MEDIAN BEAT" for the second group.
>Channel Definition Sequence	003A,0200	SQ		ALWAYS	AUTO\COPY	
>>Channel Source Sequence	003A,0208	SQ		ALWAYS	AUTO\COPY	
>>>Code Value	0008,0100	SH		ANAP	AUTO\COPY	
>>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	This will be "SCPECG"
>>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	This will be "1.3"
>>>Code Meaning	0008,0104	LO		ANAP	AUTO\COPY	
>>Channel Sensitivity	003A,0210	DS		ANAP	AUTO\COPY	
>>Channel Sensitivity Units Sequence	003A,0211	SQ		ANAP	AUTO\COPY	

>>>Code Value	0008,0100	SH	uV	ANAP	AUTO\COPY	
>>>Coding Scheme Designator	0008,0102	SH	UCUM	ANAP	AUTO\COPY	
>>>Coding Scheme Version	0008,0103	SH	1.4	ANAP	AUTO\COPY	
>>>Code Meaning	0008,0104	LO	microvolt	ANAP	AUTO\COPY	
>>Channel Sensitivity Correction Factor	003A,0212	DS		ANAP	AUTO\COPY	
>>Channel Baseline	003A,0213	DS	0	ANAP	AUTO\COPY	
>>Channel Sample Skew	003A,0215	DS	0	ANAP	AUTO\COPY	
>>Waveform Bits Stored	003A,021A	US	16	ALWAYS	AUTO\COPY	
>>Filter Low Frequency	003A,0220	DS		ANAP	AUTO\COPY	
>>Filter High Frequency	003A,0221	DS		ANAP	AUTO\COPY	
>>Noh Filter Frequency	003A,0222	DS		ANAP	AUTO\COPY	
>Waveform Bits Allocated	5400,1004	US	16	ALWAYS	AUTO\COPY	
>Waveform Sample Interpretation	5400,1006	CS	SS	ALWAYS	AUTO\COPY	
>Waveform Data	5400,1010	OW/OB		ALWAYS	AUTO\COPY	

Table 40: Waveform Annotation Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Waveform Annotation Sequence	0040,B020	SQ		ALWAYS	COPY	Sequence of Annotation Items
> Annotation Group Number	0040,A180	US	0	ALWAYS	COPY	Number identifying associated annotations. This will be "0".
> Unformatted Text Value	0070,0006	ST		ALWAYS	COPY	Text Observation Value (annotation)
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	1	ALWAYS	COPY	Number identifying associated annotations. This will be "1".
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the measurement. These are the possible values: VRate "5.10.2.5-1" RR Interval "5.10.2.1-3" PR Interval "5.13.5-7" QRS Duration "5.13.5-9" QT Interval "5.13.5-11" QTc Interval "5.10.2.5-5" P Axis "5.10.3-11" QRS Axis "5.10.3-13" T Axis "5.10.3-15"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	"SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. These are the possible values are: RR Interval, PR Interval, QRS Duration, QT Interval, QTC Interval, Ventricular Heart Rate, P Axis, QRS Axis, T Axis, P Onset, P Offset, QRS Onset, Fiducial Point, QRS Offset, T Offset and pace Maker Spike
> Numeric Value	0040,A30A	DS		ALWAYS	COPY	Numeric measurement value or values.
> Measurement Units Code Sequence	0040,08EA	SQ		ALWAYS	COPY	Units of measurement. Coded entry sequence with one item only.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the measurement unit designator. These are the possible values: VRate "{H.B.}/min" RR Interval "ms" PR Interval "ms" QRS Duration "ms" QT Interval "ms" QTc Interval "ms" P Axis "deg" QRS Axis "deg" T Axis "deg"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "UCUM".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.4".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the measurement unit. These are the possible values are: heart beats per min, millisecond, degree, point and Axis
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	2	ALWAYS	COPY	Number identifying associated annotations. This will be "2".
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the marker. These are the possible values: P Onset "5.10.3-1" P Offset "5.10.3-2" QRS Onset "5.10.3-3" Fiducial Point "5.7.1-3" QRS Offset "5.10.3-4" T Offset "5.10.3-5"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. These are the possible values: P Onset "P Onset" P Offset "P Offset" QRS Onset "QRS Onset" Fiducial Point "Fiducial Point" QRS Offset "QRS Offset" T Offset "T Offset"
> Referenced Sample Positions	0040,A132	UL		ALWAYS	COPY	List of samples within a multiplex group specifying temporal points for annotation. Position of first sample is 1. There will be only one sample position.
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	3	ALWAYS	COPY	Number identifying associated
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the marker. This will be "5.10.1.2".
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. This will be "Pacemaker spike".
> Referenced Sample Positions	0040,A132	UL		ALWAYS	COPY	List of samples within a multiplex group specifying temporal points for annotation. Position of first sample is 1. There will be only one sample position.
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).

Table 41: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Specific Character Set	0008,0005	CS	ISO_IR 100	ANAP	AUTO	
Instance Creation Date	0008,0012	DA		ANAP	AUTO	
Instance Creation Time	0008,0013	TM		ANAP	AUTO	
					AUTO	
SOP Class UID	0008,0016	UI	1.2.840.10008.5.1.4.1.1.9.1.1	ALWAYS	AUTO	
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO	
Instance Number	0020,0013	IS		ANAP	AUTO	

8.1.1.3. General ECG Waveform Storage SOP Class

Table 14: IOD of General ECG Waveform Storage SOP Class Instances

Table 42: SOP Class Modules

Information Entity	Module	Presence
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS
	Patient Study Module	ALWAYS
Series	General Series Module	ALWAYS
Equipment	Acquisition Context Module	ALWAYS
	General Equipment Module	ALWAYS
Waveform	Encapsulated Document Module	ALWAYS
	Waveform Identification Module	ALWAYS
	Waveform Module	ALWAYS
	Waveform Annotation Module	ALWAYS
	SOP Common Module	ALWAYS

Table 43: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		VNAP	COPY	
Patient ID	0010,0020	LO		VNAP	COPY	
Patient's Birth Date	0010,0030	DA		VNAP	COPY	
Patient's Sex	0010,0040	CS		VNAP	COPY	
Other Patient IDs	0010,1000	LO		ANAP	COPY	
Ethnic Group	0010,2160	SH		ANAP	COPY	

Table 44: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		VNAP	COPY	
Study Time	0008,0030	TM		VNAP	COPY	
Accession Number	0008,0050	SH		VNAP	COPY	
Referring Physician's Name	0008,0090	PN		VNAP	COPY	
Study Description	0008,1030	LO		ANAP	AUTO	
Study Instance UID	0020,000D	UI		ALWAYS	AUTO\COPY	
Study ID	0020,0010	SH		VNAP	AUTO	

Table 45: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Age	0010,1010	AS		ANAP	USER	
Patient's Size	0010,1020	DS		ANAP	USER	
Patient's Weight	0010,1030	DS		ANAP	USER	
Admission ID	0038,0010	LO		ANAP	MWL	

Table 46: General Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Modality	0008,0060	CS	"ECG"	ALWAYS	FIXED	
Operators' Name	0008,1070	PN		ANAP	USER	
Series Instance UID	0020,000E	UI		ALWAYS	AUTO	
Series Number	0020,0011	IS		VNAP	COPY	
Laterality	0020,0060	CS		ANAP	AUTO\COPY	
Performed Protocol Code Sequence	0040,0260	SQ		ALWAYS	AUTO	
>Code Value	0008,0100	SH	P2-3120E	ANAP	AUTO	
>Coding Scheme Designator	0008,0102	SH	SRT	ANAP	AUTO	
>Code Meaning	0008,0104	LO	16-lead ECG	ANAP	AUTO	

Table 47: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Manufacturer	0008,0070	LO	Philips	VNAP	AUTO	
Institution Name	0008,0080	LO		ANAP	COPY\USER	
Station Name	0008,1010	SH		ANAP	AUTO	
Institutional Department Name	0008,1040	LO		ANAP	COPY\USER	
Manufacturer's Model Name	0008,1090	LO	860426	ANAP	AUTO	
Device Serial Number	0018,1000	LO		ANAP	AUTO	
Software Versions	0018,1020	LO	B.02.03	ANAP	FIXED	

Table 48: Acquisition Context Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Acquisition Context Sequence	0040,0555	SQ		VNAP	AUTO\COPY	
>Value Type	0040,A040	CS	CODE	VNAP	AUTO\COPY	
>Concept Name Code Sequence	0040,A043	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	5.4.5-33-1	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	Electrode Placement	ANAP	AUTO\COPY	
>Concept Code Sequence	0040,A168	SQ		ALWAYS	AUTO\COPY	
>>Code Value	0008,0100	SH	5.4.5-33-1-1	ANAP	AUTO\COPY	
>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	
>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	
>>Code Meaning	0008,0104	LO	12-Lead positions: limb leads placed at extremities	ANAP	AUTO\COPY	
>Measurement Units Code Sequence	0040,08EA	SQ		ALWAYS	AUTO\COPY	Only the BP has validate value, the attribute will be created.

Note: Specified values are applicable context of the ISECG DICOM Gateway workflow.

Table 49: Waveform Identification Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Content Date	0008,0023	DA		ALWAYS	AUTO\COPY	
Acquisition Datetime	0008,002A	DT		ALWAYS	AUTO\COPY	
Content Time	0008,0033	TM		ALWAYS	AUTO\COPY	
Instance Number	0020,0013	IS		ALWAYS	AUTO\COPY	

Table 50: Waveform Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Waveform Sequence	5400,0100	SQ		ALWAYS	AUTO\COPY	
> Multiplex Group Time Offset	0018,1068	DS		ALWAYS	AUTO\COPY	
>Trigger Time Offset	0018,1069	DS		ALWAYS	AUTO\COPY	
>Waveform Originality	003A,0004	CS		ALWAYS	AUTO\COPY	This will be "ORIGINAL" for the rhythm data and "DERIVED" for median data.
>Number of Waveform Channels	003A,0005	US		ALWAYS	AUTO\COPY	
>Number of Waveform Samples	003A,0010	UL		ALWAYS	AUTO\COPY	
>Sampling Frequency	003A,001A	DS	500	ALWAYS	AUTO\COPY	Frequency in Hz
>Multiplex Group Label	003A,0020	SH		ANAP	AUTO\COPY	This is "RHYTHM" for the first group and "MEDIAN BEAT" for the second group.
>Channel Definition Sequence	003A,0200	SQ		ALWAYS	AUTO\COPY	
>>Channel Source Sequence	003A,0208	SQ		ALWAYS	AUTO\COPY	
>>>Code Value	0008,0100	SH		ANAP	AUTO\COPY	
>>>Coding Scheme Designator	0008,0102	SH	SCPECG	ANAP	AUTO\COPY	
>>>Coding Scheme Version	0008,0103	SH	1.3	ANAP	AUTO\COPY	
>>>Code Meaning	0008,0104	LO		ANAP	AUTO\COPY	
>>Channel Sensitivity	003A,0210	DS		ANAP	AUTO\COPY	
>>Channel Sensitivity Units Sequence	003A,0211	SQ		ANAP	AUTO\COPY	
>>>Code Value	0008,0100	SH	uV	ANAP	AUTO\COPY	
>>>Coding Scheme Designator	0008,0102	SH	UCUM	ANAP	AUTO\COPY	
>>>Coding Scheme Version	0008,0103	SH	1.4	ANAP	AUTO\COPY	
>>>Code Meaning	0008,0104	LO	microvolt	ANAP	AUTO\COPY	
>>Channel Sensitivity Correction Factor	003A,0212	DS		ANAP	AUTO\COPY	
>>Channel Baseline	003A,0213	DS	0	ANAP	AUTO\COPY	
>>Channel Sample Skew	003A,0215	DS	0	ANAP	AUTO\COPY	
>>Waveform Bits Stored	003A,021A	US	16	ALWAYS	AUTO\COPY	
>>Filter Low Frequency	003A,0220	DS		ANAP	AUTO\COPY	
>>Filter High Frequency	003A,0221	DS		ANAP	AUTO\COPY	
>>Notch Filter Frequency	003A,0222	DS		ANAP	AUTO\COPY	
>Waveform Bits Allocated	5400,1004	US	16	ALWAYS	AUTO\COPY	

>Waveform Sample Interpretation	5400,1006	CS	SS	ALWAYS	AUTO\COPY	
>Waveform Data	5400,1010	OW/OB		ALWAYS		

Table 51: Waveform Annotation Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Waveform Annotation Sequence	0040,B020	SQ		ALWAYS	COPY	Sequence of Annotation Items
> Annotation Group Number	0040,A180	US	0	ALWAYS	COPY	Number identifying associated annotations. This will be "0".
> Unformatted Text Value	0070,0006	ST		ALWAYS	COPY	Text Observation Value (annotation)
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	1	ALWAYS	COPY	Number identifying associated annotations. This will be "1".
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the measurement. These are the possible values: VRate "5.10.2.5-1" RR Interval "5.10.2.1-3" PR Interval "5.13.5-7" QRS Duration "5.13.5-9" QT Interval "5.13.5-11" QTc Interval "5.10.2.5-5" P Axis "5.10.3-11" QRS Axis "5.10.3-13" T Axis "5.10.3-15"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	"SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. These are the possible values are: RR Interval, PR Interval, QRS Duration, QT Interval, QTC Interval, Ventricular Heart Rate, P Axis, QRS Axis, T Axis, P Onset, P Offset, QRS Onset, Fiducial Point, QRS Offset, T Offset and pace Maker Spike
> Numeric Value	0040,A30A	DS		ALWAYS	COPY	Numeric measurement value or values.
> Measurement Units Code Sequence	0040,08EA	SQ		ALWAYS	COPY	Units of measurement. Coded entry sequence with one item only.

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the measurement unit designator. These are the possible values: VRate "{H.B.}/min" RR Interval "ms" PR Interval "ms" QRS Duration "ms" QT Interval "ms" QTc Interval "ms" P Axis "deg" QRS Axis "deg" T Axis "deg"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "UCUM".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.4".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the measurement unit. These are the possible values are: heart beats per min, millisecond, degree, point and Axis
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	2	ALWAYS	COPY	Number identifying associated annotations. This will be "2".
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the marker. These are the possible values: P Onset "5.10.3-1" P Offset "5.10.3-2" QRS Onset "5.10.3-3" Fiducial Point "5.7.1-3" QRS Offset "5.10.3-4" T Offset "5.10.3-5"
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. These are the possible values: P Onset "P Onset" P Offset "P Offset" QRS Onset "QRS Onset" Fiducial Point "Fiducial Point" QRS Offset "QRS Offset" T Offset "T Offset"
> Referenced Sample Positions	0040,A132	UL		ALWAYS	COPY	List of samples within a multiplex group specifying temporal points for annotation. Position of first sample is 1. There will be only one sample position.
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).
> Annotation Group Number	0040,A180	US	3	ALWAYS	COPY	Number identifying associated

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
> Concept Code Name Sequence	0040,A043	SQ		ALWAYS	COPY	Code representing the fully specified name of the NUMERIC measurement or CODED concept. This sequence shall contain exactly one item.
>> Code Value	0008,0100	SH		ALWAYS	COPY	This is the code for the marker. This will be "5.10.1.2".
>> Coding Scheme Designator	0008,0102	SH		ALWAYS	COPY	This will be "SCPECG".
>> Code Scheme Version	0008,0103	SH		ALWAYS	COPY	This will be "1.3".
>> Code Meaning	0008,0104	LO		ALWAYS	COPY	This is the text name of the marker. This will be "Pacemaker spike".
> Referenced Sample Positions	0040,A132	UL		ALWAYS	COPY	List of samples within a multiplex group specifying temporal points for annotation. Position of first sample is 1. There will be only one sample position.
> Referenced Waveform Channels	0040,A0B0	US		ALWAYS	COPY	List of channels in waveform to which annotation applies. This will be "0001 0000" (1,0).

Table 52: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Specific Character Set	0008,0005	CS	ISO_IR 100	ANAP	AUTO	
Instance Creation Date	0008,0012	DA		ANAP	AUTO	
Instance Creation Time	0008,0013	TM		ANAP	AUTO	
SOP Class UID	0008,0016	UI	1.2.840.10008.5.1.4.1.1.9.1.2	ALWAYS	AUTO	
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO	
Instance Number	0020,0013	IS		ANAP	AUTO	

8.1.1.4. Encapsulated PDF Storage SOP Class

Table 53: Encapsulated PDF Storage SOP Class

Information Entity	Module Name	Presence of Module
Patient	Patient	ALWAYS
Study	General Study	ALWAYS
	Patient Study	ALWAYS
	Encapsulated Document Series Module	ALWAYS
Equipment	General Equipment	ALWAYS
	SC Equipment Module	ALWAYS
Encapsulated Document	Encapsulated Document	ALWAYS
	SOP Common	ALWAYS

Table 54: Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Name	0010,0010	PN		VNAP	COPY	
Patient ID	0010,0020	LO		VNAP	COPY	
Patient's Birth Date	0010,0030	DA		VNAP	COPY	
Patient's Sex	0010,0040	CS		VNAP	COPY	
Ethnic Group	0010,2160	SH		ANAP	COPY	

Table 55: General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Study Date	0008,0020	DA		VNAP	COPY	
Study Time	0008,0030	TM		VNAP	COPY	
Accession Number	0008,0050	SH		VNAP	COPY	
Referring Physician's Name	0008,0090	PN		VNAP	COPY	
Study Instance UID	0020,000D	UI		ALWAYS	AUTO	
Study ID	0020,0010	SH		VNAP	COPY	

Table 56: Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source	Comment
Patient's Size	0010,1020	DS		ANAP	COPY	
Patient's Age	0010,1010	AS		ANAP	COPY	
Patient's Weight	0010,1030	DS		ANAP	COPY	

Table 57: Encapsulated Document Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	0008,0060	CS	ECG	ALWAYS	AUTO
Series Instance UID	0020,000E	UI		ALWAYS	AUTO
Series Number	0020,0011	IS		ALWAYS	AUTO

Table 58: General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	0008,0070	LO	Philips	VNAP	AUTO
Institution Name	0008,0080	LO		ANAP	AUTO, MWL
Institutional Department Name	0008,1040	LO		ANAP	AUTO
Manufacturer's Model Name	0008,1090	LO		ANAP	AUTO
Device Serial Number	0018,1000	LO	860426	ANAP	AUTO
Software Version(s)	0018,1020	LO	B.02.03	ANAP	FIXED

Table 59: SC Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	0008,0060	CS	ECG	ANAP	AUTO
Conversion Type	0008,0064	CS	WSD	ALWAYS	AUTO

Table 60: Encapsulated Document Module Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Content Date	0008,0023	DA		VNAP	AUTO
Acquisition Date Time	0008,002A	DT		VNAP	AUTO
Content Time	0008,0033	TM		VNAP	AUTO
Instance Number	0020,0013	IS		ALWAYS	AUTO
Burned In Annotation	0028,0301	CS	YES	ALWAYS	AUTO
Concept Name Code Sequence	0040,A043	SQ		VNAP	AUTO
Document Title	0042,0010	ST		VNAP	AUTO
Encapsulated Document	0042,0011	OB		ALWAYS	AUTO
MIME Type of Encapsulated Document	0042,0012	LO	application/pdf	ALWAYS	AUTO

Table 61: SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Specific Character Set	0008,0005	CS	ISO_IR 100	ANAP	AUTO
SOP Class UID	0008,0016	UI	1.2.840.10008.5.1.4.1.1.104.1	ALWAYS	AUTO
SOP Instance UID	0008,0018	UI		ALWAYS	AUTO
Instance Number	0020,0013	IS		ANAP	AUTO
Instance Creation Date	0008,0012	DA		ANAP	AUTO
Instance Creation Time	0008,0013	TM		ANAP	AUTO

8.1.2. Usage of Attributes from Received IOD

Not Applicable

8.1.3. Attribute Mapping

Not Applicable

8.1.4. Coerced/Modified fields

Not Applicable

8.2. Data Dictionary of Private Attributes

Not Applicable

8.3. Coded Terminology and Templates

Not Applicable

8.3.1. Context Groups

Not Applicable

8.3.2. Template Specifications

Not Applicable

8.3.3. Private code definitions

Not Applicable

8.4. Grayscale Image consistency

Not Applicable

8.5. Standard Extended/Specialized/Private SOPs

Not Applicable

8.6. Private Transfer Syntaxes

Not Applicable

