DICOM Conformance Statement

DICOMscope 2.0

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Table of Contents:

1 BACKGROUND AND INTRODUCTION

This DICOM conformance statement specifies the behavior and functionality of the DICOMscope application. This software provides the capability to demonstrate DICOM Softcopy Presentation States. The first release of this software was demonstrated at the European Congress of Radiology (ECR) in Vienna in 1999. The second, enhanced release of this software was demonstrated at the Radiological Society of North America's (RSNA) annual meeting in Chicago in 1999. This demonstration was hosted by the NEMA Committee for the Advancement of DICOM and RSNA.

This software effort was sponsored by the following DICOM member companies:

Agfa-Gevaert N.V., Aycan Digitalsysteme GmbH, BARCO/Metheus, Barco Inc., CEMAX-ICON, Cedara Software, Clinton Electronics Corporation, Compaq Computer Corporation, DOME Imaging Systems Inc., Eastman Kodak Company, GE Medical Systems, Gossen Foto und Lichtmesstechnik, IMAGE Smiths Inc., Merge Technologies Inc., Philips Medical Systems, Quintiles Intelligent Imaging, Siemens Display Technologies, Sun Microsystems Inc.

The Project team for the implementation consists of:

OTech Inc.: Main contractor and project management
OFFIS e.V.: Implementation of the DICOM toolkit software
Institute for Microtherapy; University of Witten/Herdecke: Graphical user interface

This software is available in the public domain at:

http://www.microtherapy.de/go/dicomscope/ and
http://www.offis.de/projekte/dicom/

Contact addresses:

Institute for Microtherapy
Universitätsstraße 142, D-44799 Bochum, Germany
http://www.microtherapy.de/go/cs/

Kuratorium OFFIS e.V.
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OTech Inc.
2001 East Oakshores Drive, Crossroads, TX 76227, USA
http://www.otechimg.com/

1.1 Revision History:

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1.2 Abbreviations and ACRONYMS:

ASCII	American Standard Code for Information Interchange
AE	Application Entity
ANSI	American National Standards Institute
CR	Computed Radiography
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IE	Information Entity
IOD	Information Object Definition
ISO	International Standards Organization
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol / Internet Protocol
UID	Unique Identifier
VM	Value Multiplicity
VR	Value Representation

2 SCOPE

This DICOM Conformance Statement documents the conformance of the DICOMscope software with the Digital Imaging and Communications in Medicine (DICOM) standard. This document is essential in order to evaluate whether or not an other DICOM compliant device can communicate with this software product. This statement is conformant with the recommended format as described in PS 3.2 of the DICOM standard[1].

2.1 How to use this document:

This statement consists of 5 sections:

1. **Implementation model:** The first section describes the Implementation Model. It describes the functional relation between the device and the DICOM services. A DICOM service is implemented on a device by a software process, which is called an "Application Entity" (AE). Each AE has a unique name called the "AE Title" which is used to identify it to other AE's. The AE Title is configurable to avoid two devices with the same name on a network. The "bubble diagram" (Application Data Flow Diagram) shows the interaction of the AE with the outside world across the dashed line, i. e. the DICOM interface. This Application Data Flow Diagram depicts graphically the relationship of the DICOM AE with local functions at the workstation as well as the relationship with external activities.
   One should compare this implementation model and its description with the model of the other devices that the DICOMscope software will connect to in order to determine connectivity.

2. **AE Specifications:** Each AE supports one or more Service Object Pair (SOP) classes. A SOP class consists of a combination of an object or information model with specific DICOM services. An example of such a SOP class is the CT Image Storage Class, which consists of the combination of the DICOM C_STORE command with the CT image object. Each of these classes is uniquely identified by an Identification number (UID), which is issued by the NEMA. The role of the AE is specified, which can be a client or server (compare with a speaker or listener). In DICOM terms, this is called a Service Class User or Service Class Provider (SCU or SCP).
   In order to interconnect with another device, the SOP classes as well as their role (SCU or SCP) have to be matched, i. e. a SCU has to match a SCP at another device with an identical SOP class. Make sure to compare the UID itself, not the description because there are SOP classes which have the same name, but support a different (newer) object.

3. **Presentation Context:** Each SOP class supports a particular presentation context which is the combination of the SOP Class as specified under 2. and the transfer syntax. The transfer syntax defines the encoding of the DICOM basic elements, i. e. its attributes and how the data is represented. The encoding of the data type, or Value Representation (VR), can be done in two ways – implicitly or explicitly. Explicit VR means that the transmitted data will include the VR information along with data and attribute tags. Implicit VR means the VR information will not be included, and the receiving application must determine the VR type from the Attribute Tag.
   In addition, the data can be communicated in the Little Endian (Intel) or Big Endian (Motorola, Sparc, MIPS) byte ordering. This means that for certain 16 bit words, the two 8 bit bytes might have to be swapped to be able to interpret the information by a different device. The transfer syntax of two devices have to match in order to communicate.

4. **Communication Profiles:** This section specifies the communication options. There are two levels that have to be compared. The first one is the supported communication stack that the device supports, which usually is the OSI or TCP/IP stack. In addition, the physical media has to match. Note that in general, matching physical media can be achieved by standard off-the-shelf devices. For example, if one device supports standard Ethernet 10BaseT, it can be bridged to a Fast Ethernet, ATM, or whatever is supported.

[1] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-14, 1999.

5. **Supported Attributes:** Although not required, many devices specify which DICOM attributes they require and/or store in their internal database. It is important to compare these because a mismatch could have the effect that certain functionality or applications might fail.

2.2 Warning to the reader:

If another device matches this Conformance Statement based on the comparison with its own Conformance Statement, there is a chance, but no guarantee that they interoperate. DICOM only deals with communication, it is not a standard which specifies what is needed for certain applications to run on a device.

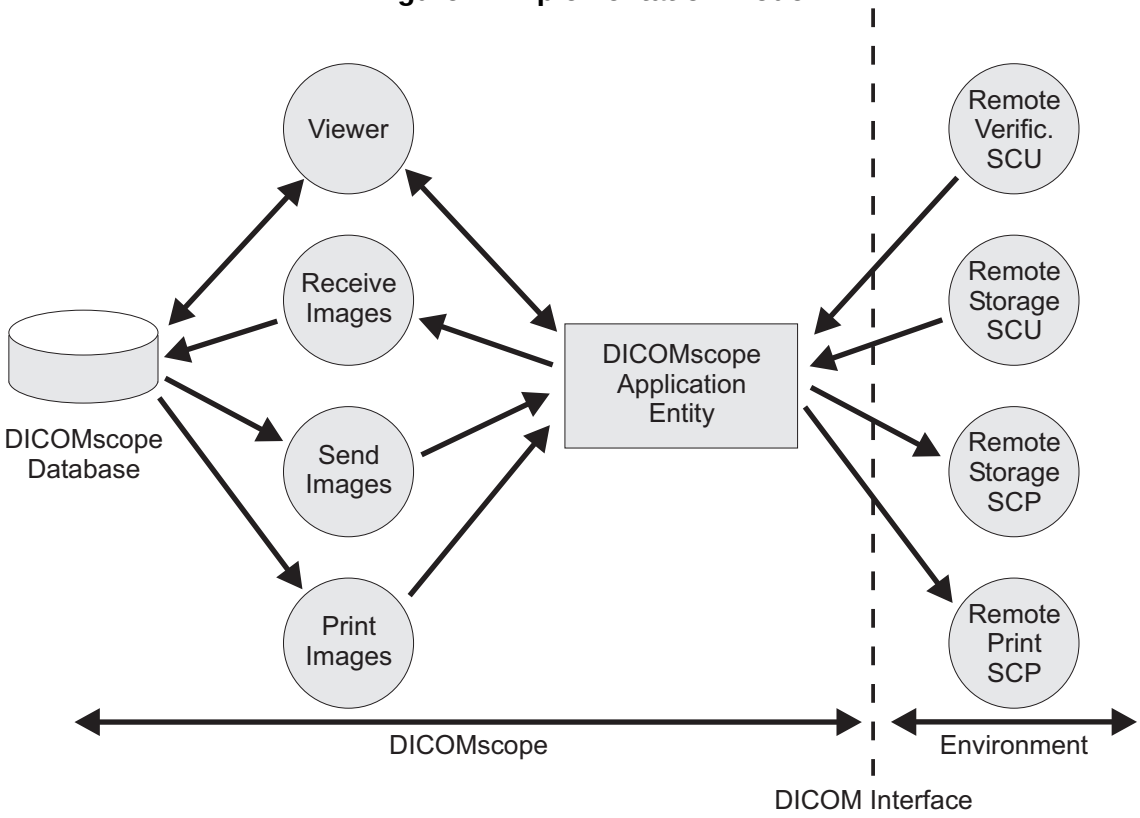
3 IMPLEMENTATION MODEL

DICOMscope receives image and Presentation State objects sent to it by remote applications using the DICOM protocol. It stores these objects in its local database for future review. It can create new Presentation State objects and store them in its local database. It can send images and presentation states to a DICOM compatible receiver. Finally, DICOMscope can act as a print client (i. e. SCU of the DICOM Print Management Service). Print jobs are stored in the local database as a study of DICOM Hardcopy Grayscale images and Stored Print objects before they get sent to the printer.

3.1 Application Data Flow Diagram

DICOMscope consists of a set of parallel, communicating but independent processes that deal with the DICOM communication. There is a process that takes care of receiving the images and storing them in the database, one that sends images out on request, and one that is responsible for the User interface. Finally, there is one spooler process for each printer known to DICOMscope which handles communication with the printer. They all share the same application entity. From a functional perspective, one could consider this as a separate Store SCP, Store SCU and Print SCU, the characteristics of which is defined further in this document.

Figure 1. Implementation Model



3.2 Functional Definitions of AEs

3.2.1 Store SCP

The Store SCP is an application entity that is automatically started together with the viewer. When the viewer is terminated, the Store SCP stops to accept any further associations and terminates as soon as all currently active associations are closed.

The Store SCP spawns a new process for each incoming DICOM association request. The association remains open until the remote application entity closes the application or until an error condition that leads to an association abort occurs.

The Store SCP implements the DICOM Storage Service as well as the Verification Service.

3.2.1.1 Store AE Specification

This application entity provides standard conformance to the following DICOM SOP classes as an SCP:

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-ray Image Storage For Present.	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra Oral X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra Oral X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
X-ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11
Stored Print Storage	1.2.840.10008.5.1.1.27
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Visible Light Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
Visible Light Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
Visible Light Slide Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3

Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Draft Visible Light Image Storage (Supp. 15 frozen 1997)	1.2.840.10008.5.1.4.1.1.77.1
Draft Visible Light Multi Frame Image Storage (Supp. 15 frozen 1997)	1.2.840.10008.5.1.4.1.1.77.2
Structured Reporting Text Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.1
Structured Reporting Audio Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.2
Structured Reporting Detail Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.3
Structured Reporting Comprehensive Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.4
Draft Waveform Storage (Supp. 30 frozen 1997)	1.2.840.10008.5.1.4.1.1.9.1
Basic Text SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.33
Twelve Lead ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.1
General ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.2
Ambulatory ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.3
Hemodynamic Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.2.1
Cardiac Electrophysiology Waveform Storage (Supp. 30 Letter Ballot)	1.2.840.10008.5.1.4.1.1.9.3.1
Basic Voice Audio Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.4.1
OFFIS Private Presentation State IPC	1.2.276.0.7230010.3.4.1915765545.18030.917282194.0

This application entity does not provide standard conformance to any SOP class as SCU.

3.2.1.2 General

The DICOM standard application context name, which is always proposed, is:

Application context name	1.2.840.10008.3.1.1.1

The maximum PDU length can be configured at installation time in the range 4096..131072 bytes. The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.2.1.3 Number of Associations

The number of parallel associations is only limited by the resources of the underlying operating system.

3.2.1.4 Asynchronous Nature

Asynchronous mode of operation is not supported.

3.2.1.5 Implementation Identifying Information

The implementation UID of this application is:

OFFIS DCMTK 3.4.1 Implementation Class UID	1.2.276.0.7230010.3.0.3.4.1

3.2.1.6 Real-World Activity "Image receipt"

The Store SCP application entity accepts an association when it receives an association request from a DICOM Storage or Verification SCU.

3.2.1.6.1 Associated Real-World Activity

The application entity waits for incoming associations. No operator action is required to receive DICOM data.

3.2.1.6.2 Association Acceptance Policy

The application entity accepts incoming association requests on a single port number defined in the configuration file. It accepts any association for which at least one presentation context is accepted. The calling and called application entity titles are ignored. The responding application entity name can be configured in the configuration file, the default is DCMPSTAT. Association requests can be rejected with the following status codes and reasons:

Result	Source	Reason	Description
rejected permanent	provider, present. related	temporary congestion	Resource limitation: process creation Failed
rejected transient	user	app. context name not supported	Incorrect application context name
rejected permanent	user	no reason	Private shutdown mechanism initiated, see section 3.4.1.1

3.2.1.6.3 Accepted Presentation Context Table

The default behavior of the Store SCP is to accept as SCP for each of the supported SOP classes all presentation contexts containing on or more of the following transfer syntaxes

Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

The default behavior can be changed in the configuration file such that only presentation contexts for supported SOP classes containing the Implicit VR Little Endian transfer syntax are accepted.

3.2.1.7 SOP Specific DICOM Conformance Statement for Storage SOP Classes

The Store SCP will receive any DICOM objects (images and non-image objects) transmitted on the open association provided that the correct presentation context is used. If the objects are received successfully, they are stored and registered in the local database. For all storage SOP classes except Grayscale Softcopy Presentation State Storage, no integrity checks of the received objects are performed beyond tests of a very basic structural integrity. In particular, the sending system is not prevented from transmitting incomplete or incorrect IODs or objects that are correct but cannot be displayed in the viewer (i. e. color images, non-image objects). Such objects will be visible in the database browser, and can be further transmitted with the Store SCU component, but they cannot be viewed.

Objects are stored in the local database as files in DICOM part 10 format with Explicit VR Little Endian transfer syntax. When objects received in Implicit VR contain attributes unknown to this application, they are stored as “unknown VR” (UN) elements. Certain element values may be changed during storage, i. e. group length values and sequence lengths are re-computed. This behavior can be changed in two ways in the configuration file:

- The support for unknown VR can be disabled. In this case, unknown elements are stored as “OB”.
- The Store SCP can be switched to “bit preserving mode”. In this case, objects are stored without any modification in the transfer syntax in which they are received.

For Grayscale Softcopy Presentation State Storage, transmitted objects are checked thoroughly. If a required element is absent or has an incorrect value, or if a feature of the Grayscale Softcopy Presentation State that is not supported by this implementation is used, the storage is rejected with the error code 0xC000: “Error, cannot understand”.

Presentation State features not supported by this application are: Mask module.

The following error/warning status codes can be sent by the Store SCP in the context of a C-STORE-RSP message:

Code	Name	Severity	Description
a700	refused: out of resources	failure	Application out of memory, file system or database write error (e. g. full)
a800	refused: SOP class not supported	failure	Received C-STORE-RQ for non-storage SOP class
a900	error: data set does not match SOP class	failure	SOP class or instance UID in C-STORE-RQ does not match UIDs in the received dataset
c000	error: cannot understand	failure	Received dataset without SOP class or instance UID; received Presentation State that failed syntax check; internal application error

3.2.1.8 Presentation Context Acceptance Criterion

The application entity will accept all presentation contexts which contain one of the supported SOP classes and one of the supported transfer syntaxes.

3.2.1.9 Transfer Syntax Selection Policies

The default behavior of the Store SCP is to select for each presentation context containing a supported SOP class the explicit VR transfer syntax with the byte order matching the local machine byte order (i. e. little endian on PC, big endian on SPARC). If this transfer syntax is not available, the explicit VR transfer syntax with opposite byte order is selected. If this is also unavailable, Implicit VR little endian is selected if available, otherwise the presentation context is rejected.

The default behaviour can be changed in the configuration file such that presentation contexts are only accepted with the default Implicit VR Little Endian transfer syntax.

3.2.2 Store SCU

The Store SCU is an application entity that is started whenever the user requests transmission of one or more objects from the local database to a remote node. When the viewer is terminated, the Store SCU continues to transmit until the transmission is completed or aborted because of a fatal error.

For each transmission request a separate Store SCU is sparked by the viewer. A transmission request may consist of the transmission of a single image, a complete series or study. All objects comprising one transmission request are transmitted over one association. When transmission is finished, the association is released and Store SCU terminates. If the transmission of an object fails because the peer Store SCP sends back an error code or no valid presentation context for the transmission of the object is available, the association is aborted and Store SCU terminates.

3.2.2.1 Store SCU AE Specification

This application entity provides standard conformance to the following DICOM SOP classes as an SCU:

SOP Class Name	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-ray Image Storage For Present.	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra Oral X-ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra Oral X-ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30

Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
X-ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11
Stored Print Storage	1.2.840.10008.5.1.1.27
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Visible Light Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
Visible Light Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
Visible Light Slide Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
Visible Light Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
X-ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
Draft Visible Light Image Storage (Supp. 15 frozen 1997)	1.2.840.10008.5.1.4.1.1.77.1
Draft Visible Light Multi Frame Image Storage (Supp. 15 frozen 1997)	1.2.840.10008.5.1.4.1.1.77.2
Structured Reporting Text Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.1
Structured Reporting Audio Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.2
Structured Reporting Detail Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.3
Structured Reporting Comprehensive Storage (Supp. 23 frozen 1997)	1.2.840.10008.5.1.4.1.1.88.4
Draft Waveform Storage (Supp. 30 frozen 1997)	1.2.840.10008.5.1.4.1.1.9.1
Basic Text SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR Storage (Supp. 23 Letter Ballot)	1.2.840.10008.5.1.4.1.1.88.33
Twelve Lead ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.1
General ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.2
Ambulatory ECG Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.1.3
Hemodynamic Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.2.1
Cardiac Electrophysiology Waveform Storage (Supp. 30 Letter Ballot)	1.2.840.10008.5.1.4.1.1.9.3.1
Basic Voice Audio Waveform Storage (Supp. 30 L. Ballot)	1.2.840.10008.5.1.4.1.1.9.4.1

This application entity does not provide standard conformance to any SOP class as SCP

3.2.2.2 General

The DICOM standard application context name, which is always proposed, is:

Application context name	1.2.840.10008.3.1.1.1

The maximum PDU length can be configured at installation time in the range 4096..131072 bytes. The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.2.2.3 Number of Associations

Store SCU will only propose a single association. However, multiple instances of Store SCU may be running at the same time. The number of parallel instances is only limited by the resources of the underlying operating system.

3.2.2.4 Asynchronous Nature

Asynchronous mode of operation is not supported.

3.2.2.5 Implementation Identifying Information

The implementation UID of this application is:

OFFIS DCMTK 3.4.1 Implementation Class UID	1.2.276.0.7230010.3.0.3.4.1

3.2.2.6 Real-World Activity "Image transmission"

An instance of the Store SCU application entity is sparked in order to execute a transmission request.

3.2.2.6.1 Associated Real-World Activity

The user selects an object, series or study in the database browser. He selects the "send" function, chooses a send target and selects "OK".

3.2.2.6.2 Association Initiation Policy

The application entity initiates an association with the selected remote Storage SCP. The calling application entity name can be configured, the default is DCMPSTATE. The called application entity name must be configured together with the presentation address to be used in the configuration file.

3.2.2.6.3 Proposed Presentation Context Table

The default behavior of the Store SCP is to propose as SCU for each of the supported SOP classes a single presentation context containing the following transfer syntaxes:

Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

The explicit VR transfer syntax with local byte order (i. e. little endian on PC, big endian on SPARC) will always be the first in the list of the proposed transfer syntaxes, followed by the explicit VR transfer syntax with opposite byte order, followed by the DICOM default transfer syntax.
The default behavior can be changed for each send target in the configuration file such that only the Implicit VR Little Endian transfer syntax is proposed instead.

3.2.3 Print SCU

For each printer known to DICOMscope, one Print SCU is started together with the viewer. Whenever the user requests a print on a particular printer, the corresponding Print SCU "spools" the print job to this printer. When the viewer is terminated, the Print SCUs continue to transmit until the print job is completed or aborted because of a fatal error. Print SCU only handles print jobs consisting of a single Film Box (page or sheet of film) which may, however, be printed in multiple copies.

3.2.3.1 Print SCU AE Specification

This application entity provides standard conformance to the following DICOM SOP classes as an SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23
Basic Annotation Box SOP Class	1.2.840.10008.5.1.1.15

This application entity does not provide standard conformance to any SOP class as SCP.

3.2.3.2 General

The DICOM standard application context name, which is always proposed, is:

Application context name	1.2.840.10008.3.1.1.1

The maximum PDU length can be configured at installation time in the range 4096..131072 bytes. The default is 16384 bytes.

SOP Class extended negotiation is not supported.

3.2.3.3 Number of Associations

Print SCU will only propose a single association. However, multiple instances of Print SCU may be running at the same time. The number of parallel instances is only limited by the resources of the underlying operating system.

3.2.3.4 Asynchronous Nature

Asynchronous mode of operation is not supported.

3.2.3.5 Implementation Identifying Information

The implementation UID of this application is:

OFFIS DCMTK 3.4.1 Implementation Class UID	1.2.276.0.7230010.3.0.3.4.1

3.2.3.6 Real-World Activity “Print Job”

An instance of the Print SCU application entity is requested to spool a print job assembled by the user on the print preview panel of the DICOMscope viewing software to a particular printer.

3.2.3.6.1 Associated Real-World Activity

The user selects an object, series or study in the database browser. He selects the “send” function, chooses a send target and selects “OK”.

3.2.3.6.2 Association Initiation Policy

The application entity initiates an association with the selected remote Storage SCP. The calling application entity name can be configured, the default is DCMPSTATE. The called application entity name must be configured together with the presentation address to be used in the configuration file.

3.2.3.6.3 Proposed Presentation Context Table

The default behavior of the Print SCP is to propose as SCU for each of the supported SOP classes a single presentation context containing the following transfer syntaxes

Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

The explicit VR transfer syntax with local byte order (i. e. little endian on PC, big endian on SPARC) will always be the first in the list of the proposed transfer syntaxes, followed by the explicit VR transfer syntax with opposite byte order, followed by the DICOM default transfer syntax.
The default behavior can be changed for each send target in the configuration file such that only the Implicit VR Little Endian transfer syntax is proposed instead.

3.2.3.6.3.1 SOP Specific Conformance for Printer SOP Class

Immediately after successful association negotiation, Print SCU issues an N-GET-RQ message in order to retrieve the contents of the well-known Printer SOP Instance. The attribute identifier list element of the message remains empty which means that the Print SCP is requested to transmit the contents of all attributes of the well-known Printer SOP Instance. If this request fails, the connection with the printer is released.
Print SCU is able to accept N-EVENT-REPORT requests from the well-known Printer SOP instance at any time (e. g. after sending one of its own requests and before receiving a reply to that request) and immediately confirms with a N-EVENT-REPORT response message. Event reports may or may not be used to notify the user of the software of the event.

3.2.3.6.3.2 SOP Specific Conformance for Basic Film Session SOP Class

After retrieval of the well-known Printer SOP instance and (optionally) the creation of a Presentation LUT SOP instance, Print SCU creates a Basic Film Session. The following elements may be sent as part of the N-CREATE request:

Attribute Name	Tag	Type	VR	VM	Comment
Number of Copies	(2000,0010)	U/M	IS	1	Sent only if specified by user
Print Priority	(2000,0020)	U/M	CS	1	Sent only if specified by user
Medium Type	(2000,0030)	U/M	CS	1	Sent only if specified by user
Film Destination	(2000,0040)	U/M	CS	1	Sent only if specified by user
Film Session Label	(2000,0050)	U/U	LO	1	Sent only if specified by user
Owner ID	(2100,0160)	U/U	SH	1	Sent only if specified by user
Referenced Presentation LUT Sequence	(2050,0500)	U/MC	SQ	1	Sent if support for the Presentation LUT SOP class was negotiated, a Presentation LUT SOP instance has been successfully created and Print SCU is configured to send the Referenced Presentation LUT SQ on Film Session level instead of Film Box.
>Referenced SOP Class UID	(0008,1150)	U/MC	UI	1	Sent if sequence is present
>Referenced SOP Instance UID	(0008,1155)	U/MC	UI	1	Sent if sequence is present
Illumination	(2010,015E)	U/MC	US	1	Sent if Referenced Presentation LUT Sequence is present
Reflected Ambient Light	(2010,0160)	U/MC	US	1	Sent if Referenced Presentation LUT Sequence is present

If creation of the Basic Film Session fails, Print SCU releases the association with the printer. After a successful completion of the print job, Print SCU uses an N-DELETE request to delete the Basic Film Session SOP instance before releasing the association. Other requests are never sent. In particular, Print SCU never sends an N-ACTION request on Basic Film Session level.

3.2.3.6.3.3 SOP Specific Conformance for Basic Film Box SOP Class

After successful creation of the Basic Film Session SOP instance, Print SCU creates a Basic Film Box. The following elements may be sent as part of the N-CREATE request:

Attribute Name	Tag	Type	VR	VM	Comment
Image Display Format	(2010,0010)	M/M	ST	1	Possible values: “STANDARD\x,y” where x,y combinations can be configured for each target printer.

Referenced Film Session Sequence	(2010,0500)	M/M	SQ	1	
>Referenced SOP Class UID	(0008,1150)	M/M	UI	1	
>Referenced SOP Instance UID	(0008,1155)	M/M	UI	1	
Film Orientation	(2010,0040)	U/M	CS	1	Sent only if specified by user
Film Size ID	(2010,0050)	U/M	CS	1	Sent only if specified by user
Magnification Type	(2010,0060)	U/M	CS	1	Sent only if specified by user
Max Density	(2010,0130)	U/M	US	1	Sent only if specified by user
Configuration Information	(2010,0150)	U/M	ST	1	Sent only if specified by user
Annotation Display Format ID	(2010,0030)	U/U	CS	1	Sent only if specified by user and support for the Basic Annotation Box SOP Class was successfully negotiated.
Smoothing Type	(2010,0080)	U/U	CS	1	Sent only if specified by user
Border Density	(2010,0100)	U/U	CS	1	Sent only if specified by user
Empty Image Density	(2010,0110)	U/U	CS	1	Sent only if specified by user
Min Density	(2010,0120)	U/U	US	1	Sent only if specified by user
Trim	(2010,0140)	U/U	CS	1	Sent only if specified by user
Requested Resolution ID	(2020,0050)	U/U	CS	1	Sent only if specified by user
Referenced Presentation LUT Sequence	(2050,0500)	U/MC	SQ	1	Sent if support for the Presentation LUT SOP class was negotiated, a Presentation LUT SOP instance has been successfully created and Print SCU is configured to send the Referenced Presentation LUT SQ on Film Box level.
>Referenced SOP Class UID	(0008,1150)	U/MC	UI	1	Sent if sequence is present
>Referenced SOP Instance UID	(0008,1155)	U/MC	UI	1	Sent if sequence is present
Illumination	(2010,015E)	U/MC	US	1	Sent if Referenced Presentation LUT Sequence is present
Reflected Ambient Light	(2010,0160)	U/MC	US	1	Sent if Referenced Presentation LUT Sequence is present

If creation of the Basic Film Box fails, Print SCU releases the association with the printer. Print SCU never creates more than a single Basic Film Box in the context of one association. Print SCU uses an N-ACTION request to request processing of the print job from the Print SCP. After a successful completion of the print job, Print SCU uses an N-DELETE request to delete the Basic Film Box SOP instance before deleting the Basic Film Session SOP instance and releasing the association. Other requests are never sent.

3.2.3.6.3.4 SOP Specific Conformance for Basic Grayscale Image Box SOP Class

For each Basic Grayscale Image Box created as part of the Basic Film Box, Print SCU issues a single N-SET request for each image box unless there are more image boxes than images to print, in which no N-SET request is sent for the unused image boxes. The following elements may be sent as part of the N-SET request:

Attribute Name	**Tag**	**Type**	**VR**	**VM**	**Comment**
Image Position	(2020,0010)	M/M	US	1	
Basic Grayscale Image Sequence	(2020,0110)	M/M	SQ	1	
>Samples Per Pixel	(0028,0002)	M/M	US	1	Value is 1
>Photometric Interpretation	(0028,0004)	M/M	CS	1	Value is “MONOCHROME2”

>Rows	(0028,0010)	M/M	US	1	
>Columns	(0028,0011)	M/M	US	1	
>Pixel Aspect Ratio	(0028,0034)	MC/M			Sent if pixel aspect ratio is not 1\1
>Bits Allocated	(0028,0100)	M/M	US	1	Value is 16 unless Print SCU has been configured to send 8-bit bitmaps to the printer, in which case the value is 8
>Bits Stored	(0028,0101)	M/M	US	1	Value is 12 if Bits Allocated is 16, 8 otherwise
>High Bit	(0028,0102)	M/M	US	1	Value is 11 if Bits Allocated is 16, 7 otherwise
>Pixel Representation	(0028,0103)	M/M	US	1	Value is 0
>Pixel Data	(7FE0,0010)	M/M	OW	1	See note below
Polarity	(2020,0020)	U/M	CS	1	Sent only if specified by user
Magnification Type	(2010,0060)	U/U	CS	1	Sent only if specified by user
Smoothing Type	(2010,0080)	U/U	CS	1	Sent only if specified by user
Configuration Information	(2010,0150)	U/U	ST	1	Sent only if specified by user
Requested Image Size	(2020,0030)	U/U	DS	1	Sent only if specified by user
Requested Decimate/Crop Behavior	(2020,0040)	U/U	CS	1	Sent only if specified by user

If support for the Presentation LUT SOP Class has not been negotiated with the Print SCP, then Print SCU assumes that the printer uses a display curve related to the DICOM Grayscale Display Standard Function with viewing conditions (illumination and reflection) defined in a proprietary manner outside the print protocol. All images will be sent in P-values, with all Presentation LUTs "burned in" as if a Presentation LUT Shape of "IDENTITY" had been negotiated.

3.2.3.6.3.5 SOP Specific Conformance for Presentation LUT SOP Class

If support for the Presentation LUT SOP Class has been negotiated, Print SCU creates a Presentation LUT SOP instance immediately after association negotiation. The following elements may be sent as part of the N-CREATE request:

Attribute Name	**Tag**	**Type**	**VR**	**VM**	**Comment**
Presentation LUT Sequence	(2050,0010)	MC/M	SQ	1	Sent if Presentation LUT Shape is not present. Only one item
>LUT Descriptor	(0028,3002)	MC/M	US/ SS	3	Sent if sequence is present
>LUT Explanation	(0028,3003)	U/U	LO	1	May or may not be sent depending on the contents of the presentation LUT files used by the DICOMscope application
>LUT Data	(0028,3006)	MC/M	OW/ US/ SS	1/ 1-n/ 1-n	Sent if sequence is present, VR depends on the contents of the presentation LUT files used by the DICOMscope application
Presentation LUT Shape	(2050,0020)	MC/M	CS	1	Sent if Presentation LUT Sequence is not present

Print SCU never creates more than a single Presentation LUT as part of a single association. If a print job contains images that are to be printed with different Presentation LUTs, then Print SCU renders the Presentation LUTs into the image data before sending it to the printer and uses a Presentation LUT Shape of IDENTITY for the print job.
The Presentation LUT SOP instance is deleted with an N-DELETE request after completion of the print job and before release of the association.

3.2.3.6.3.6 SOP Specific Conformance for Basic Annotation Box SOP Class

If support for the Basic Annotation Box SOP Class has been negotiated and Annotation Boxes have been created as part of the Basic Film Box, Print SCU may issue a single N-SET request for each annotation box. The following elements may be sent as part of the N-SET request:

Attribute Name	Tag	Type	VR	VM	Comment
Annotation position	(2030,0010)	M/M	US	1	
Text String	(2030,0020)	U/M	LO	1	

3.3 Communication Profiles

3.3.1 Supported Communication Stacks

DICOM Upper Layer over TCP/IP is supported.

3.3.2 OSI Stack

Not supported.

3.3.3 TCP/IP Stack

The TCP/IP stack is inherited from the underlying operating system

3.3.3.1 API

The application makes use of the Berkeley Sockets interface on Unix and of the WinSock interface on Win32 platforms.

3.3.3.2 Physical Media Support

DICOM is indifferent to the physical medium over which TCP/IP executes.

3.3.4 Point-to-Point Stack

Not supported.

3.4 Extensions / Specializations / Privatizations

3.4.1 Standard Extended /Specialized/Private SOPs

3.4.1.1 OFFIS Private Presentation State IPC

This private SOP class is only used for inter-process communication between components of this application. At the time being, the Store SCP application entity will refuse any association request proposing this SOP class in a presentation context with one of the supported transfer syntaxes. After that the process awaiting incoming association requests will terminate, i. e. shutdown the Store SCP. However, this behavior may change in future versions.

3.4.2 Private Transfer Syntaxes

Not supported or negotiated.

3.5 Configuration

3.5.1 AE Title / Presentation Address Mapping

The mapping of application entity titles to presentation addresses is configurable in the configuration file (not at runtime), see details below.

3.5.2 Configurable Parameters

3.5.2.1 Store SCP

For the Store SCP component, the following parameters are configurable:

- Listening IP port number
- Maximum PDU size (4096..131072)
- Application entity title (default: DCMPSTAT). This entity title is also used by StoreSCU and PrintSCU.
- Support for explicit VR transfer syntaxes (default: on)
- Support for UN value representation (default: on)
- Bit-preserving receipt (default: off)

3.5.2.2 Store SCU

For the Store SCU component, the following parameters are configurable for each send target:

- Presentation address (DNS hostname or IP address)
- IP port number
- Called application entity title
- Maximum PDU size (4096..131072)

The number of send targets is not restricted. Store SCU always uses the same application entity title as the Store SCP.

3.5.2.3 Print SCU

For the Print SCU component, the following parameters are configurable for each target (Print SCP):

- Presentation address (DNS hostname or IP address)
- IP port number
- Called application entity title
- Maximum PDU size (4096..131072)
- Support for explicit VR transfer syntaxes (default: on)
- Support for UN value representation (default: on)
- Support for image transmission with 12 bits/pixel instead of 8 bits/pixel (default: on)
- Support for the Presentation LUT SOP Class (default: off)
- Support for DICOM Correction Proposal 173 (creation of Referenced Presentation LUT Sequence, Illumination and Reflected Ambient Light on Film Box level instead of Film Session level, default: on)
- Support for the optional Image Size attribute in the Basic Grayscale Image Box SOP Class (default: off). If switched on, allows to print images in “TRUE SIZE” if demanded by a presentation state.
- Support for the optional Decimate/Crop Behaviour Element in the Basic Grayscale Image Box SOP Class (default:off). Not used currently.
- Support for the optional Trim element in the Basic Film Box SOP Class (default: off)
- Whether or not the Print SCP requires that the number of entries in a Presentation LUT matches the image bitmap (4096 entries for 12 bits/pixel, 256 entries for 8 bits/pixel, default: on). If switched on, all Presentation LUTs not fulfilling this requirement are rendered into the image bitmap before it is sent to the printer and a Presentation LUT Shape of IDENTITY is used in the Print SCP.
- Whether a Presentation LUT that could be processed both by the Print SCU and the Print SCP without consequences should be processed in the Print SCU or in the Print SCP (default: Print SCU).
- Whether or not the Print SCP “abuses” the Film Session Label attribute in the Basic Film Session SOP Class as a replacement for Annotation Box. In this case, an annotation may be transmitted in the Basic Film Session Label attribute.

3.6 Support of extended character sets

This application supports only ISO_IR 100 (ISO 8859-1 Latin 1) as extended character set.

4 INFORMATION OBJECT IMPLEMENTATION

This section specifies the subsets of DICOM Information Object Definitions (IOD) used to represent the information objects produced by this implementation.

4.1 Grayscale Softcopy Presentation State IOD

This section describes the Grayscale Softcopy Presentation State IODs which are created by this implementation. Attributes which are not mentioned in the Module tables are not created by this application and are ignored when reading a Presentation State object.

Note: Unlike versions 1.x of the DICOMscope software, which were based on the frozen draft for trial implementation of the Grayscale Softcopy Presentation State Storage supplement, this version is based on the final text. Therefore, Presentation State objects cannot be exchanged between version 1.x and 2.x.

4.1.1 Grayscale Softcopy Presentation State IOD Modules

IE	Module	Usage	Reference
Patient	Patient	M	4.1.2.1
Study	General Study	M	4.1.2.2
	Patient Study	U	4.1.2.3
Series	General Series	M	4.1.2.4
	Presentation Series	M	4.1.2.5
Equipment	General Equipment	M	4.1.2.6
Presentation	Presentation State	M	4.1.2.7
	Mask	C	4.1.2.8
	Display Shutter	C	4.1.2.9
	Bitmap Display Shutter	C	4.1.2.10
	Overlay Plane	C	4.1.2.11
	Overlay/Curve Activation	C	4.1.2.12
	Displayed Area	M	4.1.2.13
	Graphic Annotation	C	4.1.2.14
	Spatial Transformation	C	4.1.2.15
	Graphic Layer	C	4.1.2.16
	Modality LUT	C	4.1.2.17
	Softcopy VOI LUT	C	4.1.2.18
	Softcopy Presentation LUT	M	4.1.2.19
	SOP Common	M	4.1.2.20

4.1.2 Grayscale Softcopy Presentation State Module Descriptions

4.1.2.1 Patient Module

Attribute Name	Tag	Type	VR	VM	Comment
Patient's Name	(0010,0010)	2	PN	1	Copied from referenced image object
Patient ID	(0010,0020)	2	LO	1	Copied from referenced image object
Patient's Birth Date	(0010,0030)	2	DA	1	Copied from referenced image object
Patient's Sex	(0010,0040)	2	CS	1	Copied from referenced image object

4.1.2.2 General Study Module

Attribute Name	Tag	Type	VR	VM	Comment
Study Instance UID	(0020,000D)	1	UI	1	Copied from referenced image object
Study Date	(0008,0020)	2	DA	1	Copied from referenced image object

Study Time	(0008,0030)	2	TM	1	Copied from referenced image object
Referring Physician's Name	(0008,0090)	2	PN	1	Copied from referenced image object
Study ID	(0020,0010)	2	SH	1	Copied from referenced image object
Accession Number	(0008,0050)	2	SH	1	Copied from referenced image object

4.1.2.3 Patient Study Module

This optional module is not supported. When creating Presentation State objects, it is never sent. When reading Presentation State objects, it is ignored if present.

4.1.2.4 General Series Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Enumerated value 'PR'
Series Instance UID	(0020,000E)	1	UI	1	
Series Number	(0020,0011)	2	IS	1	
Laterality	(0020,0060)	2c	CS	1	Never sent; ignored when read

4.1.2.5 Presentation Series Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Enumerated value 'PR'

4.1.2.6 General Equipment Module

Attribute Name	Tag	Type	VR	VM	Comment
Manufacturer	(0008,0070)	2	LO	1	Copied from referenced image object

4.1.2.7 Presentation State Module

Attribute Name	Tag	Type	VR	VM	Comment
Instance Number	(0020,0013)	1	IS	1	
Presentation Label	(0070,0080)	1	CS	1	
Presentation Description	(0070,0081)	2	LO	1	User defined text
Presentation Creation Date	(0070,0082)	1	DA	1	Date of initial creation (not last modification) of presentation state
Presentation Creation Time	(0070,0083)	1	TM	1	Time of initial creation (not last modification) of presentation state
Presentation Creator's Name	(0070,0084)	2	PN	1	User defined text
Referenced Series Sequence	(0008,1115)	1	SQ	1	
>Series Instance UID	(0020,000E)	1c	UI	1	
>Retrieve AE Title	(0008,0054)	3	AE	1-n	
>Storage Media File-Set ID	(0088,0130)	3	SH	1	
>Storage Media File-Set UID	(0088,0140)	3	UI	1	
>Referenced Image Sequence	(0008,1140)	1c	SQ	1	
>>Referenced SOP Class UID	(0008,1150)	1c	UI	1	
>>Reference SOP Instance UID	(0008,1155)	1c	UI	1	
>>Referenced Frame Number	(0008,1160)	1c	IS	1-n	VM re-defined in Supplement 33
Shutter	(0018,1622)	1c	US	1	

Presentation Value					
Mask Subtraction Sequence	(0028,6100)	1c	SQ	1	Unsupported. See Mask Module for details.
>Mask Operation	(0028,6101)	1	CS	1	Unsupported. See Mask Module for details.
Recommended Viewing Mode	(0028,1090)	1c	CS	1	Unsupported. See Mask Module for details.

4.1.2.8 Mask Module

The Mask Module is not supported by this implementation. When writing a Presentation State, it is never sent. This implementation will refuse to read or display Presentation States containing the Mask Module, i. e. containing the Mask Subtraction Sequence (0028,6100).

4.1.2.9 Display Shutter Module

This conditional module is sent if a non-bitmap display shutter is present in the Presentation State.

Attribute Name	Tag	Type	VR	VM	Comment
Shutter Shape	(0018,1600)	1	CS	1-3	
Shutter Left Vertical Edge	(0018,1602)	1c	IS	1	Sent if one value of Shutter Shape is RECTANGULAR.
Shutter Right Vertical Edge	(0018,1604)	1c	IS	1	Sent if one value of Shutter Shape is RECTANGULAR.
Shutter Upper Horizontal Edge	(0018,1606)	1c	IS	1	Sent if one value of Shutter Shape is RECTANGULAR.
Shutter Lower Horizontal Edge	(0018,1608)	1c	IS	1	Sent if one value of Shutter Shape is RECTANGULAR.
Center of Circular Shutter	(0018,1610)	1c	IS	2	Sent if one value of Shutter Shape is CIRCULAR.
Radius of Circular Shutter	(0018,1612)	1c	IS	1	Sent if one value of Shutter Shape is CIRCULAR.
Vertices of the Polygonal Shutter	(0018,1620)	1c	IS	2-2n	Sent if one value of Shutter Shape is POLYGONAL.
Shutter Presentation Value	(0018,1622)	3	US	1	Always sent.

4.1.2.10 Bitmap Display Shutter Module

This conditional module is sent if a bitmap display shutter is present in the Presentation State.

Attribute Name	Tag	Type	VR	VM	Comment
Shutter Shape	(0018,1600)	1	CS	1-3	Enumerated value: BITMAP
Shutter Overlay Group	(0018,1623)	1	US	1	
Shutter Presentation Value	(0018,1622)	1	US	1	

4.1.2.11 Overlay Plane Module

This conditional module is sent if an overlay or bitmap shutter is present in the presentation state (as opposed to being only referenced from the presentation state).

Attribute Name	Tag	Type	VR	VM	Comment
Overlay Rows	(60xx,0010)	1	US	1	
Overlay Columns	(60xx,0011)	1	US	1	
Overlay Type	(60xx,0040)	1	CS	1	Enumerated Values: G, R
Overlay Origin	(60xx,0050)	1	SS	2	
Overlay Bits Allocated	(60xx,0100)	1	US	1	
Overlay Bit Position	(60xx,0102)	1	US	1	
Overlay Data	(60xx,3000)	1c	OW	1	Always sent if module is present. Required to be present when reading.

Overlay Description	(60xx,0022)	3	LO	1	Sent if value defined by user
Overlay Label	(60xx,1500)	3	LO	1	Sent if value defined by user

4.1.2.12 Overlay / Curve Activation Module

This conditional module is sent if bitmap overlays or curve data are referenced in the image(s) to which the Presentation State applies, or if the Overlay Plane Module is present.

Attribute Name	Tag	Type	VR	VM	Comment
Overlay Activation Layer	(60xx,1001)	2c	CS	1	
Curve Activation Layer	(50xx,1001)	2c	CS	1	

4.1.2.13 Displayed Area Module

Attribute Name	Tag	Type	VR	VM	Comment
Displayed Area Selection SQ	(0070,005A)	1	SQ	1	
>Referenced Image Sequence	(0008,1140)	1C	SQ	1	Sent if the displayed area selection in this Item does not apply to all the images listed in the Presentation State Module.
>>Referenced SOP Class UID	(0008,1150)	1C	UI	1	Sent if sequence is present
>>Referenced SOP Instance UID	(0008,1155)	1C	UI	1	Sent if sequence is present
>>Referenced Frame Number	(0008,1160)	1C	IS	1-n	Sent if sequence item is present and the referenced image is a multi-frame image and the displayed area selection does not apply to all frames. Note: VM re-defined in Supplement 33.
>Displayed Area Top Left Hand Corner	(0070,0052)	1	SL	2	
>Displayed Area Bottom Right Hand Corner	(0070,0053)	1	SL	2	
>Presentation Size Mode	(0070,0100)	1	CS	1	Enumerated Values: SCALE TO FIT, TRUE SIZE, MAGNIFY.
>Presentation Pixel Spacing	(0070,0101)	1C	DS	2	Sent if Presentation Size Mode (0070,0100) is TRUE SIZE. May be sent otherwise as well.
>Presentation Pixel Aspect Ratio	(0070,0102)	1C	IS	2	Sent if Presentation Pixel Spacing is not present.
>Presentation Pixel Magnification Ratio	(0070,0103)	1C	FL	1	Sent if Presentation Size Mode is MAGNIFY.

4.1.2.14 Graphic Annotation Module

This conditional module is sent if one or more graphic or textual annotations are present in the Presentation State.

Attribute Name	Tag	Type	VR	VM	Comment
Graphic Annotation Sequence	(0070,0001)	1	SQ	1	
>Referenced Image Sequence	(0008,1140)	1C	SQ	1	Sent if the annotations in this Item do not apply to all the images listed in the Presentation State Module.
>>Referenced SOP Class UID	(0008,1150)	1C	UI	1	Sent if sequence is present
>>Referenced SOP	(0008,1155)	1C	UI	1	Sent if sequence is present

Instance UID					
>>Referenced Frame Number	(0008,1160)	1C	IS	1-n	Sent if sequence item is present and the referenced image is a multi-frame image and the annotations do not apply to all frames. Note: VM re-defined in Supplement 33.
>Graphic Layer	(0070,0002)	1	CS	1	
>Text Object Sequence	(0070,0008)	1c	SQ	1	Sent when text objects are present in the graphic annotation.
>>Bounding Box Annotation Units	(0070,0003)	1c	CS	1	
>>Anchor Point Annotation Units	(0070,0004)	1c	CS	1	
>>Unformatted Text Value	(0070,0006)	1	ST	1	
>>Bounding Box Top Left Hand Corner	(0070,0010)	1c	FL	2	
>>Bounding Box Bottom Right Hand Corner	(0070,0011)	1c	FL	2	
>>Bounding Box Text Horizontal Justification	(0070,0012)	1c	CS	1	
>>Anchor Point	(0070,0014)	1c	FL	2	
>>Anchor Point Visibility	(0070,0015)	1c	CS	1	
>Graphic Object Sequence	(0070,0009)	1c	SQ	1	Sent when graphic objects are present in the graphic annotation.
>>Graphic Annotation Units	(0070,0005)	1	CS	1	
>>Graphic Dimensions	(0070,0020)	1	US	1	Enumerated Value: 2
>>Number of Graphic Points	(0070,0021)	1	US	1	
>> Graphic Data	(0070,0022)	1	FL	2-n	
>>Graphic Type	(0070,0023)	1	CS	1	
>>Graphic Filled	(0070,0024)	1c	CS	1	

4.1.2.15 Spatial Transformation Module

This conditional module is sent if the Presentation State requires that the image be rotated or flipped.

Attribute Name	**Tag**	**Type**	**VR**	**VM**	**Comment**
Image Rotation	(0070,0042)	1	US	1	Enumerated Values: 0, 90,180,270
Image Horizontal Flip	(0070,0041)	1	CS	1	Enumerated Values: Y, N

4.1.2.16 Graphic Layer Module

This conditional module is sent if graphical annotations are present in the Presentation State, i. e. if the Graphic Annotation Module or the Overlay/Curve Activation Module is present.

Attribute Name	**Tag**	**Type**	**VR**	**VM**	**Comment**
Graphic Layer Sequence	(0070,0060)	1	SQ	1	
>Graphic Layer	(0070,0002)	1	CS	1	
>Graphic Layer Order	(0070,0062)	1	IS	1	

>Graphic Layer Recommended Display Grayscale Value	(0070,0066)	3	US	1	
>Graphic Layer Recommended Display RGB Value	(0070,0067)	3	US	3	
>Graphic Layer Description	(0070,0068)	3	LO	1	Sent if value defined by user

4.1.2.17 Modality LUT Module

This conditional module is sent if the Presentation State contains a modality transformation. When creating a Presentation State for an existing image object, a modality transformation that is present in the image is copied into the Presentation State.

Attribute Name	Tag	Type	VR	VM	Comment
Modality LUT Sequence	(0028,3000)	1c	SQ	1	Copied from referenced image object
>LUT Descriptor	(0028,3002)	1c	US/ SS	3	Copied from referenced image object
>LUT Explanation	(0028,3003)	3	LO	1	Copied from referenced image object
>Modality LUT Type	(0028,3004)	1c	LO	1	Copied from referenced image object
>LUT Data	(0028,3006)	1c	OW/ US/ SS	1-n	Copied from referenced image object
Rescale Intercept	(0028,1052)	1c	DS	1	Copied from referenced image object
Rescale Slope	(0028,1053)	1c	DS	1	Copied from referenced image object
Rescale Type	(0028,1054)	1c	LO	1	Copied from referenced image object if present, default value: US (unspecified)

4.1.2.18 Softcopy VOI LUT Module

This conditional module is sent if the Presentation State contains a value of interest (VOI) transformation. When creating a Presentation State for an existing image object, VOI transformations present in the image object can be copied into the Presentation State (under user control).

Attribute Name	Tag	Type	VR	VM	Comment
Softcopy VOI LUT Sequence	(0028,3110)	1	SQ	1	
>Referenced Image Sequence	(0008,1140)	1C	SQ	1	Sent if the VOI LUT in this Item does not apply to all the images listed in the Presentation State Module.
>>Referenced SOP Class UID	(0008,1150)	1C	UI	1	Sent if sequence is present
>>Referenced SOP Instance UID	(0008,1155)	1C	UI	1	Sent if sequence is present
>>Referenced Frame Number	(0008,1160)	1C	IS	1-n	Sent if sequence item is present and the referenced image is a multi-frame image and the VOI LUT does not apply to all frames. Note: VM re-defined in Supplement 33.
>VOI LUT Sequence	(0028,3010)	1c	SQ	1	Copied from referenced image object
>>LUT Descriptor	(0028,3002)	1c	US/ SS	3	Copied from referenced image object
>>LUT Explanation	(0028,3003)	3	LO	1	Copied from referenced image object
>>LUT Data	(0028,3006)	1c	OW/ US/	1-n	Copied from referenced image object

			SS		
>Window Center	(0028,1050)	1c	DS	1-n	Copied from referenced image object (first value, only if no VOI LUT SQ)
>Window Width	(0028,1051)	1c	DS	1-n	Copied from referenced image object (first value, only if no VOI LUT SQ)
>Window Center & Width Explanation	(0028,1055)	3	LO	1-n	Copied from referenced image object (first value, only if no VOI LUT SQ)

4.1.2.19 Softcopy Presentation LUT Module

Attribute Name	Tag	Type	VR	VM	Comment
Presentation LUT Sequence	(2050,0010)	1c	SQ	1	
>LUT Descriptor	(0028,3002)	1c	US/ SS	3	
>LUT Explanation	(0028,3003)	3	LO	1	
>LUT Data	(0028,3006)	1c	OW/ US/ SS	1-n	
Presentation LUT Shape	(2050,0020)	1c	CS	1	Enumerated values: NORMAL, INVERSE

4.1.2.20 SOP Common Module

Attribute Name	Tag	Type	VR	VM	Comment
SOP Class UID	(0008,0016)	1	UI	1	Grayscale Softcopy Presentation State Storage: “1.2.840.10008.5.1.4.1.1.11.1”
SOP Instance UID	(0008,0018)	1	UI	1	
Specific Character Set	(0008,0005)	1c	CS	1-n	Sent if an extended character set is used in the presentation state.
Instance Creation Date	(0008,0012)	3	DA	1	Date of creation (or last modification) of the presentation state, always sent.
Instance Creation Time	(0008,0013)	3	TM	1	Time of creation (or last modification) of the presentation state, always sent.
Instance Creator UID	(0008,0014)	3	UI	1	Sent if read from existing presentation state before.

4.2 Secondary Capture IOD

This section describes the Secondary Capture IODs which are created by this implementation when the user activates the “screen snapshot” (save screen) function.

4.2.1 Secondary Capture IOD Modules

IE	Module	Usage	Reference
Patient	Patient	M	4.2.2.1
Study	General Study	M	4.2.2.2
	Patient Study	U	Never sent
Series	General Series	M	4.2.2.3
Equipment	General Equipment	U	Never sent
	SC Equipment	M	4.2.2.4
Image	General Image	M	4.2.2.5
	Image Pixel	M	4.2.2.6
	SC Image	M	4.2.2.7
	Overlay Plane	U	Never sent
	Modality LUT	U	Never sent
	VOI LUT	U	Never sent
	SOP Common	M	4.2.2.8

4.2.2 Secondary Capture Module Descriptions

4.2.2.1 Patient Module

Attribute Name	Tag	Type	VR	VM	Comment
Patient's Name	(0010,0010)	2	PN	1	Empty field sent
Patient ID	(0010,0020)	2	LO	1	Empty field sent
Patient's Birth Date	(0010,0030)	2	DA	1	Empty field sent
Patient's Sex	(0010,0040)	2	CS	1	Empty field sent

4.2.2.2 General Study Module

Attribute Name	Tag	Type	VR	VM	Comment
Study Instance UID	(0020,000D)	1	UI	1	
Study Date	(0008,0020)	2	DA	1	Empty field sent
Study Time	(0008,0030)	2	TM	1	Empty field sent
Referring Physician's Name	(0008,0090)	2	PN	1	Empty field sent
Study ID	(0020,0010)	2	SH	1	Empty field sent
Accession Number	(0008,0050)	2	SH	1	Empty field sent

4.2.2.3 General Series Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Enumerated value 'OT'
Series Instance UID	(0020,000E)	1	UI	1	
Series Number	(0020,0011)	2	IS	1	Empty field sent
Laterality	(0020,0060)	2c	CS	1	Empty field sent

4.2.2.4 SC Equipment Module

Attribute Name	Tag	Type	VR	VM	Comment
Conversion Type	(0008,0064)	1	CS	1	Enumerated value 'WSD'

4.2.2.5 General Image Module

Attribute Name	Tag	Type	VR	VM	Comment
Instance Number	(0020,0013)	2	IS	1	Empty field sent
Patient Orientation	(0020,0020)	2c	CS	2	Never sent
Image Date	(0008,0023)	2c	DA	1	Never sent
Image Time	(0008,0033)	2c	TM	1	Never sent

4.2.2.6 Image Pixel Module

Attribute Name	Tag	Type	VR	VM	Comment
Samples per Pixel	(0028,0002)	1	US	1	Value sent: 1
Photometric Interpretation	(0028,0004)	1	CS	1	Defined term: "MONOCHROME2"
Rows	(0028,0010)	1	US	1	
Columns	(0028,0011)	1	US	1	
Bits Allocated	(0028,0100)	1	US	1	Value sent: 8
Bits Stored	(0028,0101)	1	US	1	Value sent: 8
High Bit	(0028,0102)	1	US	1	Value sent: 7
Pixel Representation	(0028,0103)	1	US	1	Enumerated value: 0
Pixel Data	(7FE0,0010)	1	OW/ OB	1	Always sent as OW
Planar Configuration	(0028,0006)	1c	US	1	Never sent
Pixel Aspect Ratio	(0028,0034)	1c	IS	2	Sent if pixels are non-square

4.2.2.7 SC Image Module

Attribute Name	Tag	Type	VR	VM	Comment
Date of Secondary Capture	(0018,1012)	3	DA	1	Never sent
Time of Secondary Capture	(0018,1014)	3	TM	1	Never sent

4.2.2.8 SOP Common Module

Attribute Name	Tag	Type	VR	VM	Comment
SOP Class UID	(0008,0016)	1	UI	1	Secondary Capture Image Storage: "1.2.840.10008.5.1.4.1.1.7"
SOP Instance UID	(0008,0018)	1	UI	1	
Specific Character Set	(0008,0005)	1c	CS	1-n	Never sent

4.3 Hardcopy Grayscale IOD

This section describes the Hardcopy Grayscale IODs which are created by this implementation when the user activates the “add to print” function. A print job that is spooled to the printer consists of one Stored Print IOD and one or more Hardcopy Grayscale IOD that are used by the Print SCU to create a print-out on a Print SCP.
The Hardcopy Grayscale objects created by DICOMscope are conforming with the Hardcopy Grayscale Image Storage SOP Class as Standard Extended SOP Class. In addition to elements defined in the standard IOD, an optional Presentation LUT Sequence is added. This contains the Presentation LUT intended to be used when printing the Hardcopy Grayscale image. This addition allows to re-use a Hardcopy Grayscale image for a new print job (Stored Print object) while maintaining the presentation LUT that was used to print the hardcopy image for the first time.

4.3.1 Hardcopy Grayscale IOD Modules

IE	Module	Usage	Reference
Patient	Patient	M	4.3.2.1
Study	General Study	M	4.3.2.2
	Patient Study	U	Never sent
Series	General Series	M	4.3.2.3
Equipment	General Equipment	U	Never sent
	Hardcopy Equipment	M	4.3.2.4
Image	General Image	M	4.3.2.5
	HC Grayscale Image	M	4.3.2.6
	SOP Common Information	M	4.3.2.7
Presentation	*HC Presentation LUT*	*U*	*4.3.2.8*

4.3.2 Hardcopy Grayscale IOD Module Descriptions

4.3.2.1 Patient Module

Attribute Name	Tag	Type	VR	VM	Comment
Patient's Name	(0010,0010)	2	PN	1	Copied from referenced image object
Patient ID	(0010,0020)	2	LO	1	Copied from referenced image object
Patient's Birth Date	(0010,0030)	2	DA	1	Copied from referenced image object
Patient's Sex	(0010,0040)	2	CS	1	Copied from referenced image object

4.3.2.2 General Study Module

Attribute Name	Tag	Type	VR	VM	Comment
Study Instance UID	(0020,000D)	1	UI	1	Values consistent with Stored Print
Study Date	(0008,0020)	2	DA	1	Values consistent with Stored Print

Study Time	(0008,0030)	2	TM	1	Values consistent with Stored Print
Referring Physician's Name	(0008,0090)	2	PN	1	Values consistent with Stored Print
Study ID	(0020,0010)	2	SH	1	Values consistent with Stored Print
Accession Number	(0008,0050)	2	SH	1	Values consistent with Stored Print

4.3.2.3 General Series Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Enumerated value 'HC'
Series Instance UID	(0020,000E)	1	UI	1	
Series Number	(0020,0011)	2	IS	1	
Laterality	(0020,0060)	2c	CS	1	Never sent

4.3.2.4 Hardcopy Equipment Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Enumerated value 'HC'
Hardcopy Creation Device ID	(0018,1011)	3	LO	1	Never sent
Hardcopy Device Manufacturer	(0018,1017)	3	LO	1	'OFFIS'
Hardcopy Device Software Versions	(0018,101A)	3	LO	1-n	'3.4.1'
Hardcopy Device Manufacturer's Model Name	(0018,101B)	3	LO	1	Never sent

4.3.2.5 General Image Module

Attribute Name	Tag	Type	VR	VM	Comment
Instance Number	(0020,0013)	2	IS	1	Empty field sent
Patient Orientation	(0020,0020)	2c	CS	2	Empty field sent
Image Type	(0008,0008)	3	CS	1-n	'DERIVED\SECONDARY'
Derivation Description	(0008,2111)	3	ST	1	'Hardcopy rendered using Presentation State'
Source Image Sequence	(0008,2112)	3	SQ	1	This sequence is always sent with two items. The first items references the image from which this hardcopy was derived, the second one references the presentation state that was used to render this hardcopy.
>Referenced SOP Class UID	(0008,1150)	1C	UI	1	Always sent
>Referenced SOP Instance UID	(0008,1155)	1C	UI	1	Always sent
>Referenced Frame Number	(0008,1160)	1C	IS	1-n	Never sent

4.3.2.6 HC Grayscale Image Module

Attribute Name	Tag	Type	VR	VM	Comment
Samples Per Pixel	(0028,0002)	1	US	1	Enumerated Value: 1
Photometric Interpretation	(0028,0004)	1	CS	1	Enumerated Value: 'MONOCHROME2'
Rows	(0028,0010)	1	US	1	
Columns	(0028,0011)	1	US	1	
Pixel Aspect Ratio	(0028,0034)	1c	IS	2	Sent if the aspect ratio is not 1\1.
Bits Allocated	(0028,0100)	1	US	1	Enumerated Value: 16
Bits Stored	(0028,0101)	1	US	1	Enumerated Value: 12

High Bit	(0028,0102)	1	US	1	Enumerated Value: 11
Pixel Representation	(0028,0103)	1	US	1	Enumerated Value: 0
Pixel Data	(7FE0,0010	1	OW/ OB	1	Always sent as OW

4.3.2.7 SOP Common Information Module

Attribute Name	Tag	Type	VR	VM	Comment
SOP Class UID	(0008,0016)	1	UI	1	Hardcopy Grayscale Image Storage: "1.2.840.10008.5.1.1.29"
SOP Instance UID	(0008,0018)	1	UI	1	
Specific Character Set	(0008,0005)	1c	CS	1-n	Never sent
Instance Creation Date	(0008,0012)	3	DA	1	Always sent
Instance Creation Time	(0008,0013)	3	TM	1	Always sent

4.3.2.8 HC Presentation LUT Module (Standard Extended SOP Class)

Attribute Name	Tag	Type	VR	VM	Comment
Presentation LUT Sequence	(2050,0010)	3	SQ	1	If present, only a single item is sent
>>LUT Descriptor	(0028,3002)	1c	US/ SS	3	Sent if sequence is present
>>LUT Explanation	(0028,3003)	3	LO	1	
>>LUT Data	(0028,3006)	1c	OW/ US/ SS	1-n	Sent if sequence is present

4.4 Stored Print IOD

4.4.1 Stored Print IOD Modules

IE	Module	Usage	Reference
Patient	Patient	M	4.4.2.1
Study	General Study	M	4.4.2.2
	Patient Study	U	Never sent, ignored when read.
Series	General Series	M	4.4.2.3
Equipment	General Equipment	M	4.4.2.4
	Printer Characteristics	M	4.4.2.5
Image	Film Box	M	4.4.2.6
	Image Box List	M	4.4.2.7
	Annotation List	U	4.4.2.8
	Image Overlay Box List	U	Never sent, ignored when read.
	Presentation LUT List	U	4.4.2.9
	SOP Common Information	M	4.4.2.10

4.4.2 Stored Print IOD Module Descriptions

4.4.2.1 Patient Module

Attribute Name	Tag	Type	VR	VM	Comment
Patient's Name	(0010,0010)	2	PN	1	'^^^^'
Patient ID	(0010,0020)	2	LO	1	Empty field sent
Patient's Birth Date	(0010,0030)	2	DA	1	Empty field sent

Patient's Sex	(0010,0040)	2	CS	1	Empty field sent

4.4.2.2 General Study Module

Attribute Name	Tag	Type	VR	VM	Comment
Study Instance UID	(0020,000D)	1	UI	1	All print jobs created during one run of the DICOMscope software use the same Study Instance UID.
Study Date	(0008,0020)	2	DA	1	Always sent
Study Time	(0008,0030)	2	TM	1	Always sent
Referring Physician's Name	(0008,0090)	2	PN	1	Empty field sent
Study ID	(0020,0010)	2	SH	1	Empty field sent
Accession Number	(0008,0050)	2	SH	1	Empty field sent

4.4.2.3 General Series Module

Attribute Name	Tag	Type	VR	VM	Comment
Modality	(0008,0060)	1	CS	1	Defined term 'STORED_PRINT' – *note*: this term is not defined in PS 3.3. It is used by the DICOMscope application to distinguish between stored print objects and hardcopy grayscale images which use the 'HC' (Hardcopy) modality.
Series Instance UID	(0020,000E)	1	UI	1	
Series Number	(0020,0011)	2	IS	1	Empty field sent
Laterality	(0020,0060)	2c	CS	1	Never sent, ignored when read.

4.4.2.4 General Equipment Module

Attribute Name	Tag	Type	VR	VM	Comment
Manufacturer	(0008,0070)	2	LO	1	Empty field sent

4.4.2.5 Printer Characteristics Module

Attribute Name	Tag	Type	VR	VM	Comment
Print Management Capabilities SQ	(2130,0010)	1	SQ	1	SOP classes are: Basic Film Session, Basic Film Box, Basic Grayscale Image Box, Image Storage SOP Classes referenced by this object (normally Hardcopy Grayscale Image Storage), Presentation LUT (if present) and Basic Annotation Box (if present).
>Referenced SOP Class UID	(0008,1150)	1	UI	1	
Printer Characteristics SQ	(2130,0015)	2	SQ	1	Empty sequence sent

4.4.2.6 Film Box Module

Attribute Name	Tag	Type	VR	VM	Comment
Instance Number	(0020,0013)	2	IS	1	Empty field sent
Film Box Content Sequence	(2130,0030)	1	SQ	1	
>Image Display Format	(2010,0010)	1	ST	1	
>Annotation Display Format ID	(2010,0030)	3	CS	1	Sent if Annotation Box contained in the object
>Film Orientation	(2010,0040)	2	CS	1	
>Film Size ID	(2010,0050)	2	CS	1	
>Magnification	(2010,0060)	2	CS	1	

Type					
>Smoothing Type	(2010,0080)	3	CS	1	May be sent if specified by user
>Border Density	(2010,0100)	3	CS	1	May be sent if specified by user
>Empty Image Density	(2010,0110)	3	CS	1	May be sent if specified by user
>Min Density	(2010,0120)	3	US	1	May be sent if specified by user
>Max Density	(2010,0130)	2	US	1	May be sent if specified by user
>Trim	(2010,0140)	3	CS	1	May be sent if specified by user
>Configuration Information	(2010,0150)	2	ST	1	
>Illumination	(2010,015E)	2C	US	1	Sent if Presentation LUT SOP Class is present
>Reflected Ambient Light	(2010,0160)	2C	US	1	Sent if Presentation LUT SOP Class is present
>Requested Resolution ID	(2020,0050)	3	CS	1	May be sent if specified by user
>Referenced Presentation LUT Sequence	(2050,0500)	1C	SQ	1	Sent if Presentation LUT SOP Class is present
>>Referenced SOP Instance UID	(0008,1155)	1C	UI	1	Sent if sequence is present

4.4.2.7 Image Box List Module

Attribute Name	**Tag**	**Type**	**VR**	**VM**	**Comment**
Image Box Content Sequence	(2130,0040)	1	SQ	1	
>SOP Instance UID	(0008,0018)	1C	UI	1	Sent if sequence is present
>Image Position	(2020,0010)	1	US	1	
>Polarity	(2020,0020)	2	CS	1	
>Magnification Type	(2010,0060)	3	CS	1	May be sent if specified by user
>Configuration Information	(2010,0150)	3	ST	1	May be sent if specified by user
>Smoothing Type	(2010,0080)	3	CS	1	May be sent if specified by user
>Requested Image Size	(2020,0030)	3	DS	1	May be sent if specified by user
>Requested Decimate/Crop Behavior	(2020,0040)	3	CS	1	May be sent if specified by user
>Referenced Image Sequence	(0008,1140)	1	SQ	1	
>>Retrieve AE Title	(0008,0054)	1	AE	1-n	
>>Referenced SOP Class UID	(0008,1150)	1	UI	1	
>>Referenced SOP Instance UID	(0008,1155)	1	UI	1	
>>Study Instance UID	(0020,000D)	1	UI	1	
>>Series Instance UID	(0020,000E)	1	UI	1	
>>Referenced Frame Number	(0008,1160)	1C	IS	1	Sent if referenced image is multi-frame
>>Patient ID	(0010,0020)	2	LO	1	Empty field sent
>Referenced Image Overlay Box Sequence	(2020,0130)	1C	SQ	1	Never sent, ignored when read
>Referenced Presentation LUT Sequence	(2050,0500)	1C	SQ	1	Sent if Presentation LUT is attached to image box

>>Referenced SOP Instance UID	(0008,1155)	1C	UI	1	Sent if sequence is present

4.4.2.8 Annotation List Module

Attribute Name	Tag	Type	VR	VM	Comment
Annotation Content Sequence	(2130,0050)	3	SQ	1	Sent if print jobs contains annotations
>SOP Instance UID	(0008,0018)	1C	UI	1	Sent if sequence is present
>Annotation Position	(2030,0010)	1C	US	1	Sent if sequence is present
>Text String	(2030,0020)	1C	LO	1	Sent if sequence is present

4.4.2.9 Presentation LUT List Module

Attribute Name	Tag	Type	VR	VM	Comment
Presentation LUT Content Sequence	(2130,0080)	3	SQ	1	Sent if print job contains Presentation LUTs
>SOP Instance UID	(0008,0018)	1C	UI	1	Sent if sequence is present
>Presentation LUT Sequence	(2050,0010)	1C	SQ	1	Sent if sequence is present
>>LUT Descriptor	(0028,3002)	1C	US/ SS	3	Sent if Presentation LUT Sequence is present
>>LUT Explanation	(0028,3003)	3	LO	1	May or may not be sent depending on the contents of the presentation LUT files used by the DICOMscope application
>>LUT Data	(0028,3006)	1C	OW/ US/ SS	1/ 1-n/ 1-n	Sent if Presentation LUT Sequence is present
>Presentation LUT Shape	(2050,0020)	1C	CS	1	Sent if sequence item is present and Presentation LUT Sequence is not present in sequence item

4.4.2.10 SOP Common Information Module

Attribute Name	Tag	Type	VR	VM	Comment
SOP Class UID	(0008,0016)	1	UI	1	Stored Print Storage: “1.2.840.10008.5.1.1.27”
SOP Instance UID	(0008,0018)	1	UI	1	
Specific Character Set	(0008,0005)	1c	CS	1-n	Sent if an extended character set is used in the print job.
Instance Creation Date	(0008,0012)	3	DA	1	Date of creation (or last modification) of the stored print object, always sent.
Instance Creation Time	(0008,0013)	3	TM	1	Time of creation (or last modification) of the stored print object, always sent.