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DICOM Conformance Statement

Company name:	Zengel Medizintechnik GmbH
Product name:	CDRobot3
Version:	1.2.4.10
Revision:	1.1
Author:	Grischa Zengel
Date:	2014-03-07

1. CONFORMANCE STATEMENT OVERVIEW

The product CDRobot3 is used to produce patients discs. It provides a DICOM interface for receiving medical image data. The CDRobot3 application uses a burning robot system to produce CD, DVD or Blu-ray media.

It supports the following DICOM functionality:

- DICOM Verification service for SCP
- Storage of DICOM objects
- Writing DICOM Objects to CD-R/DVD-R/Blu-ray

Figure 1
CDRobot3 in a DICOM NETWORK overview

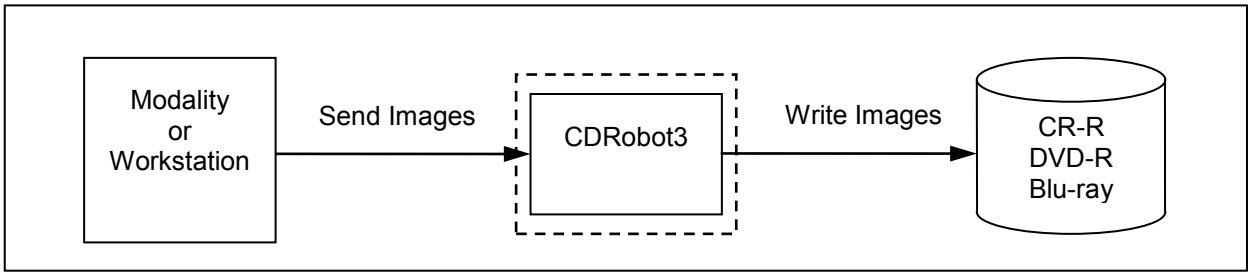

Table 1-1
Network Services

SOP Classes		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Other			
Verification SOP Class	1.2.840.10008.1.1	No	Yes
Transfer			
ComputedRadiographyImageStorage	1.2.840.10008.5.1.4.1.1.1	No	Yes
DigitalXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
DigitalXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
DigitalMammographyXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
DigitalMammographyXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes
DigitalIntraoralXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
DigitalIntraoralXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
StandaloneModalityLUTStorageRetired	1.2.840.10008.5.1.4.1.1.10	No	Yes
StandaloneVOILUTStorageRetired	1.2.840.10008.5.1.4.1.1.11	No	Yes
GrayscaleSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
ColorSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.2	No	Yes
PseudoColorSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.3	No	Yes
BlendingSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.4	No	Yes
XRayAngiographicImageStorage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
EnhancedXAImageStorage	1.2.840.10008.5.1.4.1.1.12.1.1	No	Yes
XrayRadiofluoroscopicImageStorage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
EnhancedXRFImageStorage	1.2.840.10008.5.1.4.1.1.12.2.1	No	Yes
XrayAngiographicBiPlaneImageStorageRetired	1.2.840.10008.5.1.4.1.1.12.3	No	Yes
PositronEmissionTomographyImageStorage	1.2.840.10008.5.1.4.1.1.128	No	Yes
StandalonePETCurveStorageRetired	1.2.840.10008.5.1.4.1.1.129	No	Yes
CTImageStorage	1.2.840.10008.5.1.4.1.1.2	No	Yes
EnhancedCTImageStorage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
NuclearMedicineImageStorage	1.2.840.10008.5.1.4.1.1.20	No	Yes
UltrasoundMultiframeImageStorageRetired	1.2.840.10008.5.1.4.1.1.3	No	Yes
UltrasoundMultiframeImageStorage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MRImageStorage	1.2.840.10008.5.1.4.1.1.4	No	Yes
EnhancedMRImageStorage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
MRSpectroscopyStorage	1.2.840.10008.5.1.4.1.1.4.2	No	Yes
RTImageStorage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RTDoseStorage	1.2.840.10008.5.1.4.1.1.481.2	No	Yes
RTStructureSetStorage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RTBeamsTreatmentRecordStorage	1.2.840.10008.5.1.4.1.1.481.4	No	Yes
RTPlanStorage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RTBrachyTreatmentRecordStorage	1.2.840.10008.5.1.4.1.1.481.6	No	Yes
RTTreatmentSummaryRecordStorage	1.2.840.10008.5.1.4.1.1.481.7	No	Yes
NuclearMedicineImageStorageRetired	1.2.840.10008.5.1.4.1.1.5	No	Yes
UltrasoundImageStorageRetired	1.2.840.10008.5.1.4.1.1.6	No	Yes
UltrasoundImageStorage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
RawDataStorage	1.2.840.10008.5.1.4.1.1.66	No	Yes
SpatialRegistrationStorage	1.2.840.10008.5.1.4.1.1.66.1	No	Yes
SpatialFiducialsStorage	1.2.840.10008.5.1.4.1.1.66.2	No	Yes
RealWorldValueMappingStorage	1.2.840.10008.5.1.4.1.1.67	No	Yes
SecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7	No	Yes

SOP Classes		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
MultiframeSingleBitSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
MultiframeGrayscaleByteSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
MultiframeGrayscaleWordSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
MultiframeTrueColorSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
VLImageStorageTrialRetired	1.2.840.10008.5.1.4.1.1.77.1	No	Yes
VLEndoscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.1	No	Yes
VideoEndoscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.1.1	No	Yes
VLMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.2	No	Yes
VideoMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.2.1	No	Yes
VLSlideCoordinatesMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.3	No	Yes
VLPhotographicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
VideoPhotographicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.4.1	No	Yes
OphthalmicPhotography8BitImageStorage	1.2.840.10008.5.1.4.1.1.77.1.5.1	No	Yes
OphthalmicPhotography16BitImageStorage	1.2.840.10008.5.1.4.1.1.77.1.5.2	No	Yes
StereometricRelationshipStorage	1.2.840.10008.5.1.4.1.1.77.1.5.3	No	Yes
VLMultiframeImageStorageTrialRetired	1.2.840.10008.5.1.4.1.1.77.2	No	Yes
StandaloneOverlayStorageRetired	1.2.840.10008.5.1.4.1.1.8	No	Yes
ProcedureLogStorage	1.2.840.10008.5.1.4.1.1.88.40	No	Yes
KeyObjectSelectionDocumentStorage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes
EncapsulatedPDFStorage	1.2.840.10008.5.1.4.1.1.104.1	No	Yes
EncapsulatedCDAStorage	1.2.840.10008.5.1.4.1.1.104.2	No	Yes
StandaloneCurveStorageRetired	1.2.840.10008.5.1.4.1.1.9	No	Yes
_12leadECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes
GeneralECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes
AmbulatoryECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes
HemodynamicWaveformStorage	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes
CardiacElectrophysiologyWaveformStorage	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes
BasicVoiceAudioWaveformStorage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes
HangingProtocolStorage	1.2.840.10008.5.1.4.38.1	No	Yes
SiemensCSANonImageStorage	1.3.12.2.1107.5.9.1	No	Yes
Dcm4cheAttributesModificationNotificationSOPClass	1.2.40.0.13.1.3.1.2.3.1.1	No	Yes

Table 1-2
Network Services IF STRUCTURED REPORTS ARE CONFIGURED TO BE ACCEPTED

SOP Classes		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Transfer			
BasicTextSRStorage	1.2.840.10008.5.1.4.1.1.88.11	NO?	Yes
EnhancedSRStorage	1.2.840.10008.5.1.4.1.1.88.22		Yes
ComprehensiveSRStorage	1.2.840.10008.5.1.4.1.1.88.33		Yes
MammographyCADSRStorage	1.2.840.10008.5.1.4.1.1.88.50		Yes
ChestCADSRStorage	1.2.840.10008.5.1.4.1.1.88.65		Yes
XRayRadiationDoseSRStorage	1.2.840.10008.5.1.4.1.1.88.67		Yes

CDRobot3 supports CD-R, DVD and Blu-ray as medium.

Image compression is not supported. Finalization of the media will be set after the burning process has finished.

Table **3**
Media Services

Media Storage Application Profile	**Write Files (FSC)**	**Read Files (FSR)**
Compact Disk – Recordable		
General Purpose CD-R	Yes	No
120 mm DVD (other than DVD-RAM)		
General Purpose DVD	Yes	No
120 mm BD Medium		
General Purpose BD Medium	Yes	No

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3 INTRODUCTION

3.1 REVISION HISTORY

Version	Date	Author	Comments
0.9	2011-02-29	Grischa Zengel	Initial version
1.0	2012-08-08	André Weihe	Revised version
1.1	2014-03-07	André Weihe	Revised for current version

3.2 AUDIENCE

This document is written for the people that need to understand how CDRobot3 will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 REMARKS

The scope of this DICOM Conformance Statement is to facilitate integration between CDRobot3 and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 TERMS AND DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 BASICS OF DICOM COMMUNICATION

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts.* The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
CAD	Computer Aided Detection
CDA	Clinical Document Architecture
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
CR	Computed Radiography
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DIT	Directory Information Tree (LDAP)
DN	Distinguished Name (LDAP)
DNS	Domain Name System
DX	Digital X-ray
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
IO	Intra-oral X-ray
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
LUT	Look-up Table
MAR	Medication Administration Record
MPEG	Moving Picture Experts Group
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OP	Ophthalmic Photography
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
R	Required (Key Attribute)
RDN	Relative Distinguished Name (LDAP)
RF	Radiofluoroscopy
RIS	Radiology Information System.
RT	Radiotherapy
RWA	Real-World Activity
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
US	Ultrasound
VL	Visible Light
VR	Value Representation
XA	X-ray Angiography

3.7 REFERENCES

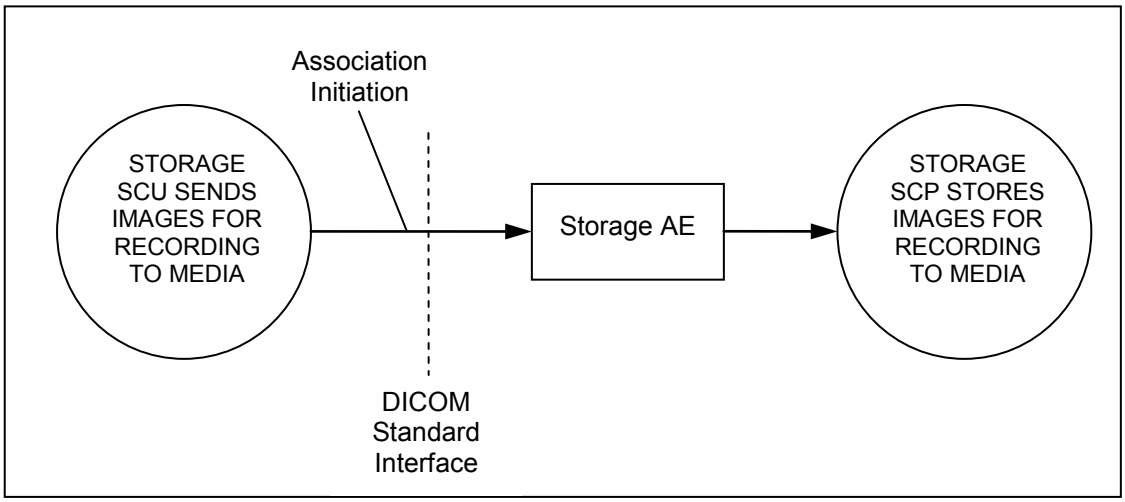
NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

Figure 2
Functional overview



4.1.2 Functional Definition of AE's

4.1.2.1 Functional Definition of Storage AE

Storage AE is an application entity that acts like an DICOM Storage Service Class and provides a Verification Service Class as SCP. The CDRobot3 application automatically starts the Storage AE. When the CDRobot3 application is terminated, Storage AE stops to accept any further associations and the associations are closed by the application.

4.1.3 Sequencing of Real World Activities

Not applicable.

4.2 AE SPECIFICATIONS:

4.2.1 Storage AE

4.2.1.1 SOP Classes

This application entity provides Standard Conformance to the following SOP Classes:

Table 4
SOP CLASSes for STORAGE AE

SOP Class Name	SOP Class UID
BasicStudyContentNotificationSOPClassRetired	1.2.840.10008.1.9
StoredPrintStorageSOPClassRetired	1.2.840.10008.5.1.1.27
HardcopyGrayscaleImageStorageSOPClassRetired	1.2.840.10008.5.1.1.29
HardcopyColorImageStorageSOPClassRetired	1.2.840.10008.5.1.1.30
ComputedRadiographyImageStorage	1.2.840.10008.5.1.4.1.1.1
DigitalXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.1
DigitalXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.1.1

SOP Class Name	SOP Class UID
DigitalMammographyXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.2
DigitalMammographyXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.2.1
DigitalIntraoralXRayImageStorageForPresentation	1.2.840.10008.5.1.4.1.1.1.3
DigitalIntraoralXRayImageStorageForProcessing	1.2.840.10008.5.1.4.1.1.1.3.1
StandaloneModalityLUTStorageRetired	1.2.840.10008.5.1.4.1.1.10
StandaloneVOILUTStorageRetired	1.2.840.10008.5.1.4.1.1.11
GrayscaleSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.1
ColorSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.2
PseudoColorSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.3
BlendingSoftcopyPresentationStateStorageSOPClass	1.2.840.10008.5.1.4.1.1.11.4
XRayAngiographicImageStorage	1.2.840.10008.5.1.4.1.1.12.1
EnhancedXAImageStorage	1.2.840.10008.5.1.4.1.1.12.1.1
XRayRadiofluoroscopicImageStorage	1.2.840.10008.5.1.4.1.1.12.2
EnhancedXRFImageStorage	1.2.840.10008.5.1.4.1.1.12.2.1
XRayAngiographicBiPlaneImageStorageRetired	1.2.840.10008.5.1.4.1.1.12.3
PositronEmissionTomographyImageStorage	1.2.840.10008.5.1.4.1.1.128
StandalonePETCurveStorageRetired	1.2.840.10008.5.1.4.1.1.129
CTImageStorage	1.2.840.10008.5.1.4.1.1.2
EnhancedCTImageStorage	1.2.840.10008.5.1.4.1.1.2.1
NuclearMedicineImageStorage	1.2.840.10008.5.1.4.1.1.20
UltrasoundMultiframeImageStorageRetired	1.2.840.10008.5.1.4.1.1.3
UltrasoundMultiframeImageStorage	1.2.840.10008.5.1.4.1.1.3.1
MRImageStorage	1.2.840.10008.5.1.4.1.1.4
EnhancedMRImageStorage	1.2.840.10008.5.1.4.1.1.4.1
MRSpectroscopyStorage	1.2.840.10008.5.1.4.1.1.4.2
RTImageStorage	1.2.840.10008.5.1.4.1.1.481.1
RTDoseStorage	1.2.840.10008.5.1.4.1.1.481.2
RTStructureSetStorage	1.2.840.10008.5.1.4.1.1.481.3
RTBeamsTreatmentRecordStorage	1.2.840.10008.5.1.4.1.1.481.4
RTPlanStorage	1.2.840.10008.5.1.4.1.1.481.5
RTBrachyTreatmentRecordStorage	1.2.840.10008.5.1.4.1.1.481.6
RTTreatmentSummaryRecordStorage	1.2.840.10008.5.1.4.1.1.481.7
NuclearMedicineImageStorageRetired	1.2.840.10008.5.1.4.1.1.5
UltrasoundImageStorageRetired	1.2.840.10008.5.1.4.1.1.6
UltrasoundImageStorage	1.2.840.10008.5.1.4.1.1.6.1
RawDataStorage	1.2.840.10008.5.1.4.1.1.66
SpatialRegistrationStorage	1.2.840.10008.5.1.4.1.1.66.1
SpatialFiducialsStorage	1.2.840.10008.5.1.4.1.1.66.2
RealWorldValueMappingStorage	1.2.840.10008.5.1.4.1.1.67
SecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7
MultiframeSingleBitSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.1
MultiframeGrayscaleByteSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.2
MultiframeGrayscaleWordSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.3
MultiframeTrueColorSecondaryCaptureImageStorage	1.2.840.10008.5.1.4.1.1.7.4
VLImageStorageTrialRetired	1.2.840.10008.5.1.4.1.1.77.1
VLEndoscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.1
VideoEndoscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.1.1

SOP Class Name	SOP Class UID
VLMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.2
VideoMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.2.1
VLSlideCoordinatesMicroscopicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.3
VLPhotographicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.4
VideoPhotographicImageStorage	1.2.840.10008.5.1.4.1.1.77.1.4.1
OphthalmicPhotography8BitImageStorage	1.2.840.10008.5.1.4.1.1.77.1.5.1
OphthalmicPhotography16BitImageStorage	1.2.840.10008.5.1.4.1.1.77.1.5.2
StereometricRelationshipStorage	1.2.840.10008.5.1.4.1.1.77.1.5.3
VLMultiframeImageStorageTrialRetired	1.2.840.10008.5.1.4.1.1.77.2
StandaloneOverlayStorageRetired	1.2.840.10008.5.1.4.1.1.8
ProcedureLogStorage	1.2.840.10008.5.1.4.1.1.88.40
KeyObjectSelectionDocumentStorage	1.2.840.10008.5.1.4.1.1.88.59
EncapsulatedPDFStorage	1.2.840.10008.5.1.4.1.1.104.1
EncapsulatedCDAStorage	1.2.840.10008.5.1.4.1.1.104.2
StandaloneCurveStorageRetired	1.2.840.10008.5.1.4.1.1.9
_12leadECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.1
GeneralECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.2
AmbulatoryECGWaveformStorage	1.2.840.10008.5.1.4.1.1.9.1.3
HemodynamicWaveformStorage	1.2.840.10008.5.1.4.1.1.9.2.1
CardiacElectrophysiologyWaveformStorage	1.2.840.10008.5.1.4.1.1.9.3.1
BasicVoiceAudioWaveformStorage	1.2.840.10008.5.1.4.1.1.9.4.1
HangingProtocolStorage	1.2.840.10008.5.1.4.38.1
SiemensCSANonImageStorage	1.3.12.2.1107.5.9.1
Dcm4cheAttributesModificationNotificationSOPClass	1.2.40.0.13.1.3.1.2.3.1.1
Philips Private Gyroscan MR Spectrum	1.3.46.670589.11.0.0.12.1
Philips Private Gyroscan MR SerieData	1.3.46.670589.11.0.0.12.2
Philips Private MR Examcard Storage	1.3.46.670589.11.0.0.12.4
Agfa Private Basic Attribute Presentation State	1.2.124.113532.3500.7

Table 5
SOP CLASSes for STORAGE AE IF STRUCTURED REPORTS ARE CONFIGURED TO BE ACCEPTED

SOP Class Name	SOP Class UID
BasicTextSRStorage	1.2.840.10008.5.1.4.1.1.88.11
EnhancedSRStorage	1.2.840.10008.5.1.4.1.1.88.22
ComprehensiveSRStorage	1.2.840.10008.5.1.4.1.1.88.33
MammographyCADSRStorage	1.2.840.10008.5.1.4.1.1.88.50
ChestCADSRStorage	1.2.840.10008.5.1.4.1.1.88.65
XRayRadiationDoseSRStorage	1.2.840.10008.5.1.4.1.1.88.67

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 6
DICOM Application Context FOR STORAGE AE

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU length on sending and receiving is 16384 bytes.

4.2.1.2.2 Number of Associations.

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

4.2.1.2.3 Asynchronous Nature

Asynchronous mode of operation is not supported by this application.

4.2.1.2.4 Implementation Identifying Information

The implementation UID of this application is:

Table 7
DICOM Implementation Class and Version for Storage AE

Implementation Class UID	1.2.826.0.1.3680043.8.685.1.1.2.4.10
Implementation Version Name	CDROBOT3_1_2_4_10

4.2.1.3 Association Initiation Policy

This application entity never initiates associations.

4.2.1.4 Association Acceptance Policy

4.2.1.4.1 Real-World Activity “Image reception”

The Storage AE application entity accepts any association when it receives an association request from a remote DICOM Store SCU or Verification SCU. This application entity accepts incoming association requests on a single port or multiple ports as defined in the configuration. Any association will be accepted if at least one presentation context is accepted. The calling application entity titles will be ignored. The responding application entity title can be configured. If no responding application entity title is configured the called application entity title will be ignored. If a responding application entity title is configured only associations directed to this application entity title will be accepted. Upon successful negotiation the data sent by the peer AE will be received and stored.

The Storage AE may reject association attempts as shown in the table below:

Table 8
ASSOCIATION REJECTION REASONS

Result	Source	Reason	Description
1- rejected permanent	user	2 - application context name not supported	The association request contained an unsupported application context name. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.
1- rejected permanent	user	3 - called AE title not recognized	The association request contained an unrecognized called AE title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

4.2.1.4.1.1 Description and sequencing Real-World Activities

The application entity waits for incoming associations.

4.2.1.4.1.2 Accepted Presentation Contexts

The default behavior of the Storage AE is to accept for each of the supported SOP classes all presentation contexts containing one or more of the following transfer syntaxes:

Table 9
Acceptable Presentation Contexts for Recording AE

Syntax		Role	Extended Negotiation
Transfer Name	**UID**		
Implicit VR Little Endian	1.2.840.10008.1.2	SCP	NONE
Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	NONE
Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	NONE

4.2.1.4.1.3 SOP Specific Conformance for SOP Classes

Images and non-image objects will be received by the Storage AE service. Objects are stored 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.

The following status codes can be sent by the Storage AE within a CSTORE-RSP message:

Table 10
Storage C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The SOP instance was successfully received and stored.
Error	Processing failure	0110	This status is returned due to internal errors such as a processing failure response from the internal database or a file system operation. The appropriate status will be sent in the C-STORE Response. An error indication message is output to the service log.
Warning	Coercion of data elements	B000	This status is returned if one or more attribute values were coerced/modified on reception. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. A warning indication message is output to the service log.
Warning	Data set does not match SOP class	B007	This status is returned if the C-STORE Request specifies Attributes that are not specific as part of the Storage SOP class. Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response. A warning indication message is output to the service log.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

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

4.3.2 Additional Protocols

Not supported.

4.3.3 IPv4 and IPv6 Support

The TCP/IP stack is inherited from the Java Runtime Environment.

4.4 CONFIGURATION

The settings of the network can be configured.

4.4.1 AE Title/Presentation Address Mapping

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

- Listening port number(s) (default: 104)
- Responding application entity title(s) (default: CDROBOT3).
- Hostname(s)
- Acceptance of structured reports (default: off)

4.4.1.2 Additional Configuration

The following burning robot systems could be connected to the CDRobot3 application:

- Primera Disc Publisher
- Primera Disc Publisher II
- Primera Disc Publisher Pro
- Primera Disc Publisher XR
- Primera Disc Publisher XRP
- Primera Disc Publisher SE
- Primera Disc Publisher SE
- Primera Disc Publisher Xi
- Primera Disc Publisher 4100
- Primera Disc Publisher 4100 XRP

5 MEDIA INTERCHANGE

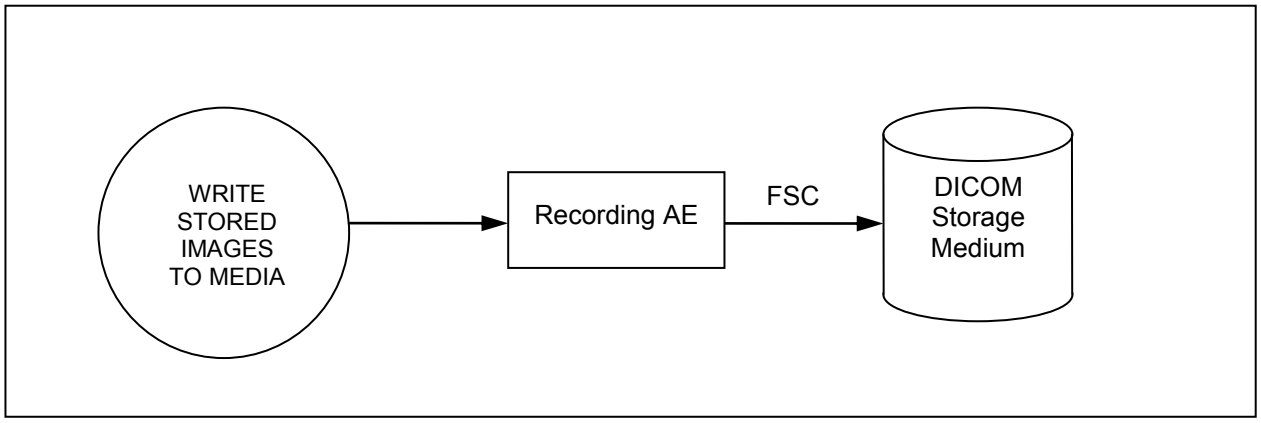
5.1 IMPLEMENTATION MODEL

The implementation model identifies the DICOM Application Entities for Media in specific implementation and relates the Application Entities to Real-World Activities.

5.1.1 Application Data Flow Diagram

The diagram Figure 5.1-1 represents the Application Entities present in an implementation and graphically depicts the relationship of the AE's use of DICOM to real world activities.

Figure 3
Application Data Flow Diagram



5.1.2 Functional definitions of AE's

The Recording AE is the only Media Application Entity within the CDRobot3 System. It includes the following service class:

Media Storage Service Class

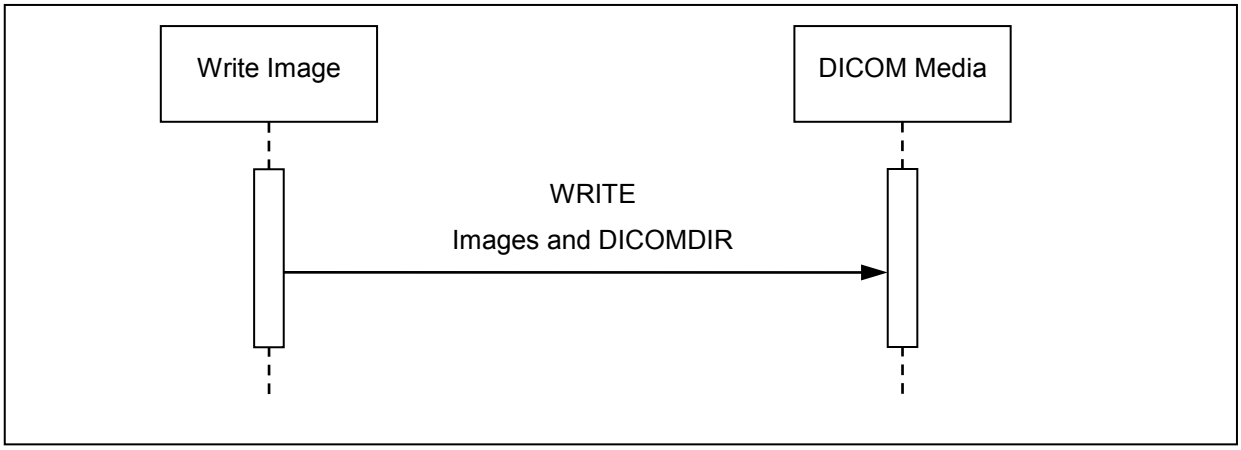
For CD-R, DVD+RW and Blu-ray the Recording AE can perform the media storage and supports the following service as SCU:

- RWA Write Image as FSC.

5.1.3 Sequencing of Real World Activities

The Recording AE writes the images and the DICOMDIR of the received examinations to the DICOM media.

Figure 4
Sequencing of RWA



5.2 AE SPECIFICATIONS

This section specifies the set of Application Entities.

5.2.1 Recording AE – Specification

The following table, Table 5.2-1, shows that for one or more Application Profiles in the first column, there are a number of Real-World Activities in the second column and the roles required for each of these Real-World Activities in the third column.

Table 11
AE Related Application Profiles, Real-World Activities and Roles

Supported Application Profile	Real-World Activity	Roles
STD-GEN-CD	Create File-Set	FSC
STD-GEN-DVD	Create File-Set	FSC
STD-GEN-BD	Create File-Set	FSC

5.2.1.1 File Meta Information for the Recording AE

The Implementation Class UID and the Implementation Version Name in the File Meta Header are as specified for networking. The Recording AE has no specific File Meta Information.

This section contains the values of the File Meta Information that pertain to the Application Entity (see PS 3.10). These are:

Table 5.2-2
File Meta Information for the Recording AE

Implementation Class UID	1.2.826.0.1.3680043.8.685.1.1.2.4.10
Implementation Version Name	CDROBOT3_1_2_4_10

5.2.1.2 Real-World Activities

The AE Specification shall contain a description of the Real-World Activities, which invoke the particular AE.

5.2.1.2.1 RWA Create File-Set

The Recording AE acts as a File-Set Creator and writes DICOM objects and the DICOMDIR onto a DICOM media.

5.2.1.2.2 Media Storage Application Profile

The Application Profile that is used by the AE described in 5.2-1 is specified in this section.

5.2.1.2.3 Options

The DICOMDIR records contains the following key values:

- Patient ID
- Study ID
- Study Instance UID
- Series Number
- Series Instance UID
- Image Number
- SOP Instance UID

5.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

Not applicable.

5.4 MEDIA CONFIGURATION

Any implementation's DICOM conformance may be dependent upon configuration that takes place at the time of installation. Issues concerning configuration shall be addressed in this section (e.g. the configuration of the Source AE Title in File Meta Information).

6 SUPPORT OF EXTENDED CHARACTER SETS

This application supports the following extended character set:

ISO_IR 100	ISO 8859-1 Latin 1

7 SECURITY

7.1 SECURITY PROFILES

None.

7.2 ASSOCIATION LEVEL SECURITY

None.

7.3 APPLICATION LEVEL SECURITY

None.

8 ANNEXES

8.1 IOD CONTENTS

8.1.1 Created SOP Instances

This section specifies each IOD created (including Private IOD's).

Abbreviations:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present with a value
EMPTY	Attribute is sent without a value

Abbreviations for the source of the data values:

USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
CONFIG	the attribute value source is a configurable parameter
COPY	the attribute value source is data received and stored from the Storage AE

Table 8.1-1
DICOM Directory Information Module

Attribute Name	Tag	VR	Presence of Value	Source
File-Set ID	0004,1130	CS	ALWAYS	AUTO
Offset of the First Directory Record of the Root Directory Entity	0004,1200	UL	ALWAYS	AUTO
Offset of the Last Directory Record of the Root Directory Entity	0004,1202	UL	ALWAYS	AUTO
File-Set Consistency Flag	0004,1212	US	ALWAYS	AUTO
Directory Record Sequence	0004,1220	SQ	ANAP	AUTO
Offset of the Next Directory Record	0004,1400	UL	ANAP	AUTO
Record in use Flag	0004,1410	UL	ANAP	AUTO
>Offset of Referenced Lower-Level Directory Entity	0004,1420	UL	ALWAYS	AUTO
>Directory Record Type	0004,1430	CS	ANAP	AUTO
>Specific Character Set	0008,0005	CS	ANAP	AUTO
>Patient's Name	0010,0010	PN	ALWAYS	COPY
>Patient ID	0010,0020	LO	ALWAYS	COPY
>Patient's Birth Date	0010,0030	DA	ALWAYS	COPY
>Patient's Sex	0010,0040	CS	ALWAYS	COPY
>Offset of the Next Directory Record	0004,1400	UL	ALWAYS	AUTO
Record in use Flag	0004,1410	UL	ANAP	AUTO
>Offset of Referenced Lower-Level Directory Entity	0004,1420	UL	ALWAYS	AUTO
>Directory Record Type	0004,1430	CS	ANAP	AUTO
>Specific Character Set	0008,0005	CS	ANAP	AUTO
>Study Date	0008,0020	DA	ALWAYS	COPY
>Study Time	0008,0030	TM	ALWAYS	COPY

Attribute Name	Tag	VR	Presence of Value	Source
>Accession Number	0008,0050	SH	ANAP	COPY
>Study Description	0008,1030	LO	VNAP	COPY
>Study Instance UID	0020,000D	UI	VNAP	COPY
>Study ID	0020,0010	SH	VNAP	COPY
>Offset of the Next Directory Record	0004,1400	UL	ALWAYS	AUTO
Record in use Flag	0004,1410	UL	ANAP	AUTO
>Offset of Referenced Lower-Level Directory Entity	0004,1420	UL	ALWAYS	AUTO
>Directory Record Type	0004,1430	CS	ANAP	AUTO
>Specific Character Set	0008,0005	CS	ANAP	AUTO
>Series Date	0008,0021	DA	VNAP	COPY
>Series Time	0008,0031	TM	VNAP	COPY
>Modality	0008,0060	CS	VNAP	COPY
Institution Name	0008,0080	LO	ANAP	COPY
Institution Address	0008,0081	ST	ANAP	COPY
Series Description	0008,103e	LO	VNAP	COPY
Performing Physician Name	0008,1050	PN	ANAP	COPY
>Series Instance UID	0020,000E	UI	VNAP	COPY
>Series Number	0020,0011	IS	VNAP	COPY
>Offset of the Next Directory Record	0004,1400	UL	ALWAYS	AUTO
Record in use Flag	0004,1410	UL	ANAP	AUTO
>Offset of Referenced Lower-Level Directory Entity	0004,1420	UL	ALWAYS	AUTO
>Directory Record Type	0004,1430	CS	ANAP	AUTO
>Referenced File ID	0004,1500	CS	ANAP	AUTO
>Referenced SOP Class UID in File	0004,1510	UI	ANAP	AUTO
>Referenced SOP Instance UID in File	0004,1511	UI	ANAP	AUTO
>Referenced Transfer Syntax UID in File	0004,1512	UI	ANAP	AUTO
>Specific Character Set	0008,0005	CS	ANAP	AUTO
>Image Type	0008,0008	CS	ANAP	AUTO
>>Referenced Image Sequence	0008,1140	SQ	VNAP	COPY
>>>Referenced SOP Class UID	0008,1150	UI	ALWAYS	COPY
>>>Referenced SOP Instance UID	0008,1155	UI	ALWAYS	COPY
>Image Position (Patient)	0020,0032	DS	VNAP	COPY
>Instance Number	0020,0013	IS	ALWAYS	COPY
>Image Orientation (Patient)	0020,0037	DS	VNAP	COPY
>Frame of Reference UID	0020,0052	UI	VNAP	COPY
>>Rows	0028,0010	US	VNAP	COPY
>>Columns	0028,0011	US	VNAP	COPY
>>Pixel Spacing	0028,0030	DS	VNAP	COPY

Private attributes will not be used.

8.1.2 Usage of Attributes from received IOD's

None.

8.1.3 Attribute Mapping

None.

8.1.4 Coerced/Modified fields

None.

8.2 DATA DICTIONARY OF PRIVATE ATTRBUTES

None.

8.3 CODED TERMINOLOGY AND TEMPLATES

None.

8.4 GRAYSCALE IMAGE CONSISTENCY

None.

8.5 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOP CLASSES

Table 8.5
PRIVATE SOP CLASSES FOR RECORDING AE

SOP Class Name	SOP Class UID
SiemensCSANonImageStorage	1.3.12.2.1107.5.9.1
Dcm4cheAttributesModificationNotificationSOPClass	1.2.40.0.13.1.3.1.2.3.1.1
Philips Private Gyroscan MR Spectrum	1.3.46.670589.11.0.0.12.1
Philips Private Gyroscan MR SerieData	1.3.46.670589.11.0.0.12.2
Philips Private MR Examcard Storage	1.3.46.670589.11.0.0.12.4
Agfa Private Basic Attribute Presentation State	1.2.124.113532.3500.7

8.6 PRIVATE TRANSFER SYNTAXES

None.