DICOM Conformance Statement

Biograph mCT VG80A

Product Name

Biograph mCT

Aug / 2022

SIEMENS Healthineers

Table 1: Network Services

SOP Classes	SOP Class UID	User of Service (SCU)		Provider of Service (SCP)	
Verification					
Verification	1.2.840.10008.1.1	Yes		Yes	
Storage					
		Create	**Send**	**Store**	**Display**
SOP Classes managed by Biograph mCT					
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes	Yes	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes	Yes	Yes
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes	Yes	Yes
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes	Yes	Yes
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	No	Yes	Yes	Yes
Digital Intra-Oral X-Ray Image - for Presentation - IMAGE	1.2.840.10008.5.1.4.1.1.1.3	No	Yes	Yes	Yes
Digital Intra-Oral X-Ray Image - for Processing - IMAGE	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes	Yes	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes	Yes	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes	Yes	Yes
Ultrasound Multi-Frame Image Storage (retired) (SCP only)	1.2.840.10008.5.1.4.1.1.3	No	Yes	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes	Yes	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes	Yes	Yes
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	No	Yes	Yes	Yes

Ultrasound Image Storage (retired) (SCP only)	1.2.840.10008.5.1.4.1.1.6	No	Yes	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	No	Yes	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	No	Yes	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	No	Yes	Yes	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	No	Yes	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	No	Yes	Yes	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	No	Yes	Yes	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	No	Yes	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes	Yes	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes	Yes	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	No	Yes	Yes	Yes
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	No	Yes	Yes	Yes
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	No	Yes	Yes	Yes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	No	Yes	Yes	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	No	Yes	Yes	Yes
Comprehensive SR Storage	1.2.840.10008.5.1.4.1.1.88.33	No	Yes	Yes	Yes
Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	No	Yes	Yes	Yes

Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	No	Yes	Yes	Yes
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	No	Yes	Yes	Yes
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	No	Yes	Yes	Yes
X-Ray Radiation Dose SR Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	Yes	Yes	Yes
Radiopharmaceutical Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.68	Yes	Yes	Yes	Yes
Encapsulated PDF Storage SOP Class	1.2.840.10008.5.1.4.1.1.104.1	No	Yes	Yes	Yes
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes	Yes	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	No	Yes	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes	Yes	Yes
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	No	Yes	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes	Yes	Yes
Radio Therapy Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	No	Yes	Yes	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	No	Yes	Yes	Yes
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	No	Yes	Yes	Yes
Transfer (Private SOP Class)					
CSA Syngo Non-Image Storage	1.3.12.2.1107.5.9.1	Yes	Yes		
Storage Commitment					
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Yes	No		
Worklist Management					
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Yes	No		
Query/Retrieve					
Patient Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes		
Patient Root Q/R - Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes		

Patient Root Q/R - Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3	No	Yes
Study Root Q/R - Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Study Root Q/R - Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Study Root Q/R - Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	No	Yes
Patient/Study Only Q/R - Information Model FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patient/Study Only Q/R - Information Model MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	Yes
Patient/Study Only Q/R - Information Model GET	1.2.840.10008.5.1.4.1.2.3.3	No	Yes
Print Management			
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Yes	No

Table 2: Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk – Recordable		
STD-GEN-CD	No	Yes
AUG-GEN-CD	Yes	Yes
STD-CTMR-CD	No	Yes
AUG CTMR CD	Yes	Yes
STD XA1K CD	No	Yes
STD XABC CD	No	Yes
PRI SYNGO CD	Yes	Yes
DVD		
PRI SYNGO DVD	Yes	Yes
TD-US-zz-yF-xxxxxx1	No	Yes

1 All combinations of the following values for zz, yF and xxxxxx are supported:

Table 3: Implementation Identifying Information

Name	Value
Application Context Name	1.2.840.100008.3.1.1.1
Implementation Class UID	1.3.12.2.1107.5.1.4 (for CT, PET) 1.3.12.2.1107.5.99.3.20080101 (for SecondaryCapture, PDF, Segmentation)
Implementation Version Name	SIEMENS_S5VC50A

'yF' can take two values: SF for Single Frame and MF for Multi Frame.
'zz' can take three values: ID (Image Display), SC(Spatial Calibration) and CC (Combined Calibration)
xxxxxx can take 2 values: CDR and DVD

1 Introduction

This document is applicable to Siemens Biograph mCT products using software PETsyngo VG80A.

PETsyngo is based on syngo, the common SW platform for Siemens medical devices, and on Somaris/7, the system software for CT products.

1.1 Revision History

Version	Date	Change
VG80A	04/08/2022	Modified structure to be in alignment with PS3.2

1.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

1.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Biograph mCT and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [1]. 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 conformance statements is the first step towards assessing interconnectivity and interoperability between Biograph mCT 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.

Siemens Healthineers reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens Healthineers representative for the most recent product information.

1.4 Definitions, Terms and Abbreviations

Definitions, terms, and abbreviations used in this document are defined within the different parts of the DICOM standard.

Additional Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ASCII	American Standard Code for Information Interchange
DCID	Defined Context Group Identifier
DCS	DICOM Conformance Statement
DICOM	Digital Imaging and Communications in Medicine

DT	Defined Term
DTID	Defined Template Identifier
EV	Enumerated Value
FSC	File Set Creator
FSR	File Set Reader
FSU	File Set Updater
GSDF	Grayscale Standard Display Function
IOD	DICOM Information Object Definition
ISO	International Standard Organization
LLI	Lower Large Intestine
n. a.	not applicable
NEMA	National Electrical Manufacturers Association
NL	Nesting Level
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
R	Required Key Attribute
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM Server)
SOP	DICOM Service-Object Pair
SR	Structured Report
TFT	Thin Film Transistor (Display)
TID	Template ID
U	Unique Key Attribute
UID	Unique Identifier
ULI	Upper Large Intestine
UTF-8	Unicode Transformation Format-8
VT	Value Type
VR	Value Representation

1.5 References

[1] NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at https://www.dicomstandard.org/)

2 Networking

2.1 Implementation Model

The Biograph mCT uses PETsyngo Software VG80A which is based on the common syngo platform and Somaris/7, the software platform for CT products, which provides the described Network Services.

The Biograph mCT supports storing PET and CT Images as well as Radiopharmaceutical Radiation Dose SR and Secondary Capture Images to remote nodes like workstations or Archiving Systems. Using the Storage Commitment Service, it can request safe keeping of previously stored instances from an Archiving system. Additionally, the Biograph mCT can query remote nodes, retrieve and store selected instances from that node. Furthermore it can also receive DICOM objects from remote nodes and answer to query/retrieve requests from remote nodes.

Using the Modality Worklist service, the Biograph mCT can query a HIS/RIS for scheduled procedures. Performed procedure status and other procedure data can be returned to the HIS/RIS using the Modality Performed Procedure Step (MPPS) Service. Furthermore, printing of color and grayscale images is supported.

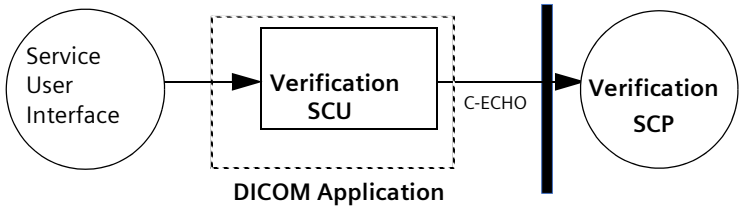
2.1.1 Verification

The Verification service class defines an application-level class of service which allows for the operator to verify the ability of an application on a remote node to respond to DICOM messages. The DICOM Service Tool application supports the Verification service to act as SCU.

The other direction – responding to Verification requests from remote applications – is handled by the Storage SCP application.

2.1.1.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU for the C-ECHO DICOM network service. The product target operating system is Windows 10



2.1.1.2 Functional Definitions of Application Entities

The DICOM Service Tool application opens an association to an application on the remote node and sends a Verification message to verify that the remote application can respond to DICOM messages

2.1.1.3 Sequencing of Real-World Activities

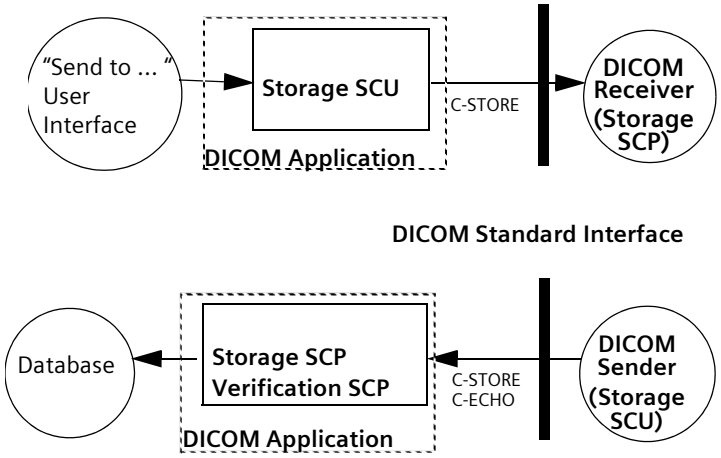
Newly configured data of a remote AE have to be saved first, before a "verification" of these data is possible

2.1.2 Storage

The Biograph mCT DICOM Application Entity both originates associations for Storage of DICOM Composite Information Objects in Remote Application Entities and accepts association requests for Storage from Remote Application Entities

2.1.2.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU and SCP for the CSTORE DICOM network service and as SCP for the C-ECHO DICOM network service.
The product target operating system is Windows 10



2.1.2.2 Functional Definitions of Application Entities

The Storage SCU is invoked by the job control interface that is responsible for processing network archiving tasks. The job consists of data describing the composite image objects selected for storage and the destination. An association is negotiated with the destination application entity and the image data is transferred using the C-STORE DIMSE-Service. Status of the transfer is reported to the job control interface.

The Storage SCP component of the Siemens Biograph mCT DICOM application is operating as background server process. It is existing, when the machine is powered on and waits for Storage association requests. Upon accepting an association with a negotiated Presentation Context, it starts to receive the Composite Image Objects and imports them to local database. Verification requests will be processed and responded to by Storage SCP component, too

2.1.2.3 Sequencing of Real-World Activities

N/A

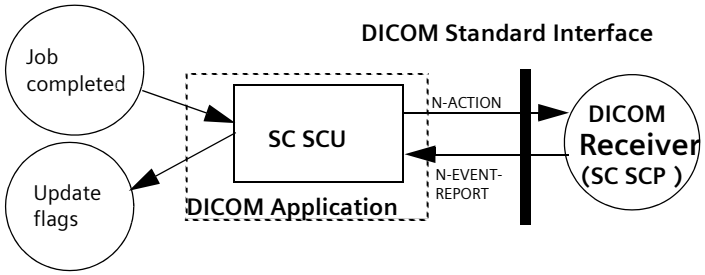
2.1.3 Storage Commitment

The Storage Commitment service class defines an application-level class of service which facilitates the commitment to storage. It performs an additional task of commitment of composite objects apart from the network-based storage of images as defined by the Storage Service class. The Biograph mCT DICOM implementation supports the Storage Commitment Push Model as SCU.

2.1.3.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU for the Storage Commitment Push Model Service using the Storage Commitment Service Class.

The product target operating system is Windows 10.



2.1.3.2 Functional Definitions of Application Entities

With each successfully completed send job the Biograph mCT DICOM application will create a Storage Commitment Push Model Identifier from the SOP Instances sent. Then a Storage Commit Request is triggered. Depending on configuration, the Biograph mCT DICOM application will keep the association open for responses with a configurable time-out or closes the association and expects responses on a different association that has to be established by the remote Storage Commitment SCP.

The commitment status derived from the related trigger response will be indicated in the Status Flags of the related entity. It is possible to create triggers ("auto rules") from this event.

The Transaction UIDs of the pending commitment request are kept "open" for a configurable amount in time (default: 1h). If the "open time" for a pending commitment request has elapsed without a related response from the provider, the Transaction UID is removed, and the related entities are indicated as "commit failed".

In any case, commitment will only be requested for previously and successfully sent images

2.1.3.3 Sequencing of Real-World Activities

The Storage Commitment trigger is automatically derived from the successful completion of a Send job.

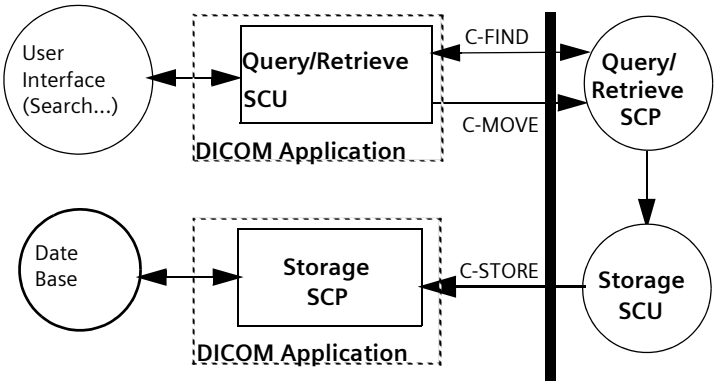
2.1.4 Query/Retrieve

The query/retrieve service class defines an application-level class of services which facilitates the management of images and patient data against the well defined information model of DICOM and allows a DICOM AE to retrieve images from a remote DICOM node or to request a remote DICOM AE to initiate a transfer of images to another DICOM AE. The DICOM query/retrieve application supports the query/retrieve services to act as SCU and SCP.

2.1.4.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU and SCP for the query/ retrieve network service.

The product target operating system is Windows 10.



2.1.4.2 Functional Definitions of Application Entities

The query/retrieve SCU requests the remote query/retrieve SCP to perform a search and match to the keys specified in the request in order to display the results in the user interface. Depending on user action (Import) the Biograph mCT DICOM SCU sends a C-MOVE DIMSE service to initiate a C-STORE sub-operation on the SCP to start an image transfer from the remote Storage SCU to the Biograph mCT DICOM Storage SCP.

The query/retrieve SCP responds to C-FIND DIMSE services from remote SCU applications. Depending on further remote request, a C-GET or a C-MOVE involves the Biograph mCT DICOM query/retrieve SCP application to initiate a C-STORE association (by triggering and parameterizing the own Storage SCU) to send image objects to a remote Storage SCP.

All components of the Biograph mCT DICOM query/retrieve SCP application are operating as background server processes. They are existing when the machine is powered on and then respond to queries based on the records stored in its database.

Note: The Biograph mCT DICOM query/retrieve SCU application will execute new queries based upon the data found in the higher level query. For details see Section 2.2.4.3.1.2

2.1.4.3 Sequencing of Real-World Activities

Retrieve of images is only possible if results from a previous "Search..." operation exist and those entities can be selected for "Import".

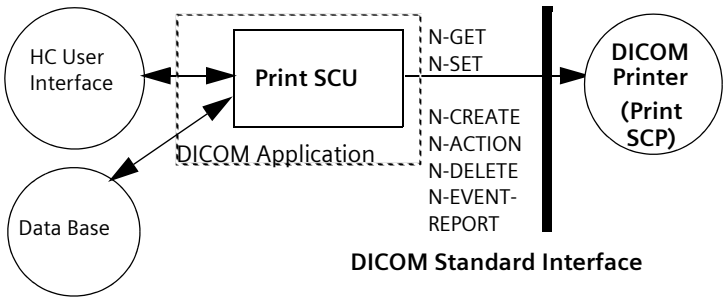
2.1.5 Print

The Print Management Service Classes define an application-level class of services which facilitate the printing of images on a hardcopy medium. The print management SCU and print management SCP are peer DICOM print management application entities. The DICOM print application supports the print management DIMSE services to act as SCU.

2.1.5.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU for the print management network service.

The product target operating system is Windows 10.



2.1.5.2 Functional Definitions of Application Entities

The Print SCU is invoked by the user interface to set up film sheet layout and whenever and image is ready to be printed on film. The print SCU will hold and maintain all data needed to compile a complete film sheet from the data (images, layout, configuration) received. Whenever a film sheet is ready to print, the related data is used to supply the information to the SOP Classes of the Print Management Service Class. A queue is maintained in order to intermediately store several film sheets in case of resource problems on printer. The SCU will only supply and require the mandatory SOP Classes of the Print Management Service Class.

2.1.5.3 Sequencing of Real-World Activities

N/A

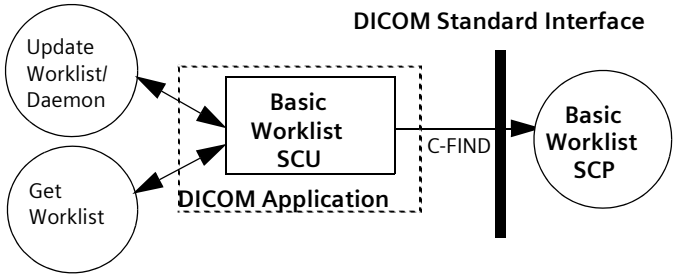
2.1.6 Worklist

The Basic Worklist Service Class defines an application-level class of service which facilitates the transfer of worklists from the information system to the imaging modality. The worklist is queried by the AE and supplies the SCU with the scheduled tasks, which have to be performed on the modality. The DICOM worklist application supports the worklist service as SCU.

2.1.6.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU for the Basic Worklist Service using the Modality Worklist SOP Class.

The product target operating system is Windows 10.



Note: It is configurable to get the worklist updates either automatically (in a configurable time interval) or manually (initiated by the user). There are two kinds of query the user can do: broad worklist query (all jobs for the own modality or own application entity) and patient-based worklist query (where more search keys can be given, including Patient Name and Patient ID).

2.1.6.2 Functional Definitions of Application Entities

The worklist SCU ("broad query") is invoked from the patient browser user interface or by timer to request the worklist from a remote Information System (Modality Worklist SCP). This is done to perform a match to the internal worklist query keys specified in the C-FIND DIMSE service issued for the Modality Worklist Model.

The Worklist SCP responds to the C-FIND query and scheduled imaging service requests (scheduled procedure steps) and patient demographic information will be downloaded from the information system to the Biograph mCT modality. All information retrieved will be held in the scheduling database for usage during patient registration procedure.

Furthermore the patient based query dialog from the patient browser allows to enter specific matching criteria (“narrow query“) for the issue worklist query. With the response data the Patient Registration dialog can be populated according availability within the worklist response identifier.

2.1.6.3 Sequencing of Real-World Activities

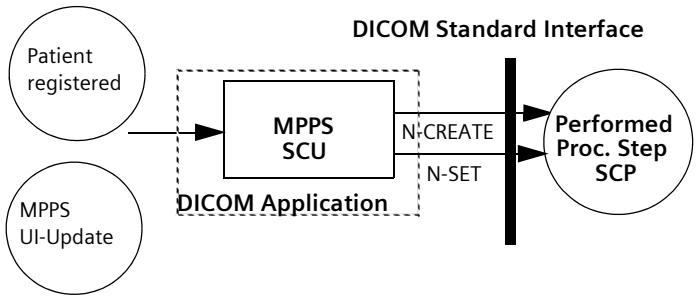
The "narrow" (patient based) Worklist Query requires that sufficient matching keys or a unique matching key are/is entered before the query is issued. Only then a single response can be expected to complete the registration dialog.

2.1.7 Modality Performed Procedure Step

The Modality Performed Procedure Step service class defines an application-level class of service which facilitates the transfer of billing and radiation dose information from the imaging modality to the information system. The performed procedure step is created and set by the AE and supplies the SCP with the information about a real world procedure which is performed on the modality. The DICOM Modality Performed Procedure Step application supports the MPPS service as SCU.

2.1.7.1 Application Data Flow Diagram

The Biograph mCT DICOM network implementation acts as SCU for the performed procedure step network service.
The target operating system is Windows 10.



2.1.7.2 Functional Definitions of Application Entities

With registration of a patient (i.e. a Scheduled Procedure Step from Worklist), the Biograph mCT DICOM application will create a MPPS instance and communicate it to the MPPS SCP.

Furthermore a manual update can be performed with the Biograph mCT MPPS user interface. Only there it is possible to set the state of the MPPS to "Completed" or "Discontinued". If done so, the DICOM application will no longer allow updates on the related MPPS Instance.

Biograph mCT will not only allow a "1:1 relationship" of Scheduled Procedure Steps and Performed Procedure Steps, but also supports the "group case" (grouping several SPS of the same or different Requested Procedures) and "append case" from the respective IHE scenarios.

Biograph mCT supports creation of "unscheduled cases" by allowing MPPS instances to be communicated for locally registered patients

2.1.7.3 Sequencing of Real-World Activities

N/A

2.2 AE Specifications

This section outlines the specifications for each of the Application Entities that are part of the Biograph mCT.

2.2.1 Verification AE Specification

2.2.1.1 SOP Classes

The Biograph mCT DICOM application provides Standard Conformance to the following DICOM V3.0 SOP Classes listed in Table 1: Network Services section "Verification" of the Conformance Statement Overview.

2.2.1.2 Association Policy

2.2.1.2.1 General

The Biograph mCT DICOM Service Tool application attempts to open an association for verification request whenever the "verification" function is activated during network configuration of a remote DICOM application.

2.2.1.2.2 Number of Associations

The Biograph mCT DICOM Service Tool application initiates one association at a time to request verification.

2.2.1.2.3 Asynchronous Nature

The Biograph mCT DICOM Service Tool application does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.1.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 3: Implementation Identifying Information in the “Conformance Statement Overview”.

2.2.1.3 Association Initiation Policy

The Biograph mCT DICOM Service Tool Application attempts to initiate a new association for

- DIMSE C-ECHO

Service operation.

2.2.1.3.1 Activity – Verification

The associated Real-World activity is a C-ECHO request initiated by the Service and Configuration SW environment whenever a "verification" is requested. If an association to a remote Application Entity is successfully established, Verification with the configured AET is requested via the open association. If the C-ECHO Response from the remote Application contains a status other than "Success" this will be indicated in the service environment and the association is closed.

2.2.1.3.1.1 Proposed Presentation Contexts

The Biograph mCT DICOM application will propose a Presentation Context as shown in the following table:

Table 4 Presentation Context for Verification SOP Class

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.1		

2.2.1.3.1.2 SOP specific Conformance for SOP classes

The Biograph mCT DICOM application conforms to the definition of a Verification SCU in accordance to the DICOM Standard.

2.2.1.4 Association Acceptance Policy

The Verification SCP is part of the Storage SCP (See Section XXX)

2.2.2 Storage AE Specification

The Biograph mCT Storage service class user applications and service class provider applications use one AE when initiating/receiving associations to/from remote DICOM nodes.

2.2.2.1 SOP Classes

The Biograph mCT DICOM implementation provides Standard Conformance to the DICOM V3.0 SOP Classes listed in Table 1: Network Services of the Conformance Statement Overview as both an SCU and SCP.

2.2.2.2 Association Policy

2.2.2.2.1 General

The existence of a job queue with network destination or an internal trigger from processing a retrieve request will activate the DICOM Storage Application. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the transfer is started.

The default PDU size will be 28 KB.

2.2.2.2.2 Number of Associations

The Biograph mCT DICOM application initiates several associations at a time, one for each destination to which a transfer request is being processed in the active job queue list.

The Biograph mCT DICOM application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel.

The number of Simultaneous DICOM associations can be configured via the Service-UI. The dialog can be found in Configuration / DICOM / General.

2.2.2.2.3 Asynchronous Nature

The Biograph mCT DICOM application does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.2.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3: Implementation Identifying Information" in the "Conformance Statement Overview".

2.2.2.3 Association Initiation Policy

If a job with network destination becomes active in the job list or a retrieve sub-operation is processed the Biograph mCT DICOM application attempts to initiate a new association for

- DIMSE C-STORE

service operations.

2.2.2.3.1 Activity – Send

The associated Real-World activities are:

- A user wants to send one or more composite objects to a remote node. A job with network destination triggers an internal process, which initiates a C-STORE request.
- A user on a remote node wants to retrieve one or more composite objects: The local C-MOVE SCP initiates C-STORE sub operations as a reaction to a C-MOVE-RQ coming from a remote node.

For both cases, if the process successfully establishes an association to a remote Application Entity, it will transfer each image one after another via the open association. If the C-STORE Response from the remote Application

2.2.2.3.1.1 Proposed Presentation Contexts

For all Image Objects listed in Table 1: Network Services in the Conformance Statement Overview the Transfer Syntaxes marked with "yes" in the Image Objects Column of the table below are supported.

For all Non-Image Objects listed in Table 1: Network Services in the Conformance Statement Overview the Transfer Syntaxes marked with "yes" in the Non-Image Objects Column of the table below are supported.

For a distinction between Image and Non-Image Objects please refer to the DICOM Standard PS3.3 Section A.1.4 "Overview of the Composite IOD Module Content [1]".

Table 5: Proposed Presentation Contexts for Storage

UID value	Transfer Syntax	Image Objects	Non-Image Objects
1.2.840.10008.1.2	Implicit Value Representation Little Endian native	Yes	Yes
1.2.840.10008.1.2.1	Explicit Value Representation Little Endian native	Yes	Yes
1.2.840.10008.1.2.2	Explicit Value Representation Big Endian	Yes	Yes
1.2.840.10008.1.2.5	RLE Lossless compressed	Yes	No
1.2.840.10008.1.2.4.50	JPEG Baseline (Process 1) lossy compressed	Yes	No
1.2.840.10008.1.2.4.51	JPEG Extended (Process 2 & 4) lossy compressed	Yes	No
1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14) lossless compressed	Yes	No
1.2.840.10008.1.2.4.91	JPEG 2000 Lossy	Yes	^No

Uncompressed transfer syntaxes are proposed together in a single presentation context for each abstract syntax. The "MOVE" destinations must be configured as Storage destinations. This will include the configuration of Transfer Syntax capabilities.

Not all the listed transfer syntaxes will be proposed all the time. For some abstract syntaxes only a list of uncompressed (UC) transfer syntaxes (one or more) will be proposed, for other abstract syntaxes also JPEG Lossless (LL) syntax will be proposed and/or a list of JPEG Lossy (LY) transfer syntaxes. The contents of this lists is configurable, e.g. UC could be configured to contain only Implicit Little Endian for instance. For further configuration details see Section 2.5.2.1

It is not possible to send an image that is locally stored in a Lossy compressed format using an uncompressed or lossless transfer syntax.

Extended negotiation is not supported.

2.2.2.3.1.2 SOP specific Conformance for SOP classes

The DICOM images created by Biograph mCT DICOM application conform to the DICOM IOD definitions (Standard Extended IODs). But they will contain additional private elements which have to be discarded by a DICOM system when modifying the image.

2.2.2.4 Association Acceptance Policy

The Biograph mCT DICOM application attempts to accept a new association for

- DIMSE C-ECHO
- DIMSE C-STORE

service operations. Any Information Object transmitted on that association will be checked for conformance and stored in the database if check was successful.

2.2.2.4.1 Activity – Receive

The daemon receiving process will accept an association and will receive any images transmitted on that association and will store the images on disk in the own database if the conformance check is performed successfully.

2.2.2.4.1.1 Accepted Presentation Contexts

For all supported Transfer Objects (see: Table 1: Network Services in the Conformance Statement Overview) the Transfer Syntaxes described in Table 6 are accepted.

Table 6: Accepted Presentation Contexts

UID value	Transfer Syntax	Image Objects	Non-Image Objects
1.2.840.10008.1.2	Implicit Value Representation Little Endian native	Yes	Yes
1.2.840.10008.1.2.1	Explicit Value Representation Little Endian native	Yes	Yes
1.2.840.10008.1.2.2	Explicit Value Representation Big Endian	Yes	Yes
1.2.840.10008.1.2.5	RLE Lossless compressed	Yes	No
1.2.840.10008.1.2.4.50	JPEG Baseline (Process 1) lossy compressed	Yes	No
1.2.840.10008.1.2.4.51	JPEG Extended (Process 2 & 4) lossy compressed	Yes	No
1.2.840.10008.1.2.4.57	JPEG Lossless Non-Hierarchical	Yes	No
1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14) lossless compressed	Yes	No
1.2.840.10008.1.2.4.80	JPEG LS lossless	Yes	No
1.2.840.10008.1.2.4.90	JPEG 2000 Lossless	Yes	No

UID value	Transfer Syntax	Image Objects	Non-Image Objects
1.2.840.10008.1.2.4.91	JPEG 2000 Lossy	Yes	^No

Notes:

- US Retired and US Multiframe Retired images are converted to US images/US Multiframe images before storing them into the local database. The conversion creates new images, which implies new UIDs.
- With RLE Lossless Transfer Syntax the DICOM application will decompress the image before storing it into the database.
- JPEG 2000 decompression supported only for import in connection with COSMOS / syngo Imaging workplace.
- Private attributes in sequence items will be removed during import in syngo.

There is no Extended Negotiation as an SCP.

2.2.2.4.1.1.1 Presentation Context Acceptance Criterion - Storage SCP

The Biograph mCT DICOM application will accept any number of Verification or storage SOP classes that are listed above. The number of presentation contexts accepted is limited to the maximum of 127 (DICOM limit). In case the Siemens Biograph mCT DICOM application runs out of resources, it will reject the association request.

2.2.2.4.1.1.2 Transfer Syntax Selection Policies - Storage SCP

The Biograph mCT DICOM application supports

- the Implicit VR Little Endian, the Explicit VR Little Endian and Explicit VR Big Endian transfer syntaxes
- the JPEG Baseline and JPEG Extended transfer syntaxes (JPEG lossy)
- the JPEG lossless Non-Hierarchical transfer syntax
- the RLE Lossless Transfer Syntax
- the JPEG 2000 Lossless and Lossy Transfer Syntax

Any proposed presentation context which includes one of these transfer syntaxes will be accepted. Any proposed presentation context that does not include one of these transfer syntaxes will be rejected.

The order of preference in accepting Transfer Syntaxes within Presentation Contexts or Presentation Contexts with single Transfer Syntaxes is:

1. JPEG Lossy Extended
2. JPEG Lossless Non-hierarchical
3. JPEG Lossy Baseline
4. RLE Lossless
5. Explicit VR Little Endian
6. Explicit VR Big Endian
7. Implicit VR Little Endian
8. JPEG 2000 Lossy
9. JPEG 2000 Lossless
10. JPEG Lossless Non-Hierarchical
11. JPEG LS LOSSLESS

With RLE Lossless Transfer Syntax the Biograph mCT application will decompress the image before storing it to the database.

With Implicit VR Little Endian Transfer Syntax the Biograph mCT DICOM application will remove any private attributes not known to the application. Decision on removal of a Private Element is done if there is NO entry in the attribute dictionary of the Biograph mCT DICOM application.

Thus any Explicit VR Transfer Syntax shall preferably be used by the Storage SCUs when sending Composite Image Instances to the Biograph mCT application.

2.2.2.4.1.2 SOP specific Conformance for SOP classes

The Biograph mCT DICOM application conforms to the Full Storage Service Class at Level 2.

Upon successfully receiving a C-STORE-RQ, the SIEMENS Biograph mCT DICOM receiver performs a quick plausibility test on the received image and available system resources. If this test succeeds, it returns the status SUCCESS, otherwise one of the following status codes is returned and the association is aborted:

- Refused (A700):
  This error status indicates a lack of Resources (e.g. not enough disk space) on the Biograph mCT modality.
- Invalid Dataset (A900):
  The dataset is not containing one of the attributes "Study Instance UID", "Series UID" or "SOP Instance UID", or one of them has an invalid value.
- Processing Error (0110 or C000):
  An error occurred while processing the image which makes it impossible to proceed.

Attention! Only after sending the response, the image will be saved into the database. If an error occurs during this operation, the association will be aborted. This implies that a C-STORE-RSP with status SUCCESS does not mean that the image was successfully stored into the database.

In order to confirm that the images sent were successfully stored into the database, the sending application should use Storage Commitment Service.

If an image instance is received that is identified by a SOP Instance UID which is already used by an Instance stored in the database then the received image will be discarded. The existing image is not superseded. So if a remote node sends twice the same image (same SOP Instance UID) then there will still be only one image (the first) in the database of the DICOM receiver.

The following sections will differentiate the attribute contents required for Image Viewing. The Biograph mCT DICOM application supports more formats for Storage of images than Viewing.

2.2.2.4.1.2.1 Image Pixel Attribute Acceptance Criterion for Grayscale Images

The Display application accepts the MONOCHROME1 and MONOCHROME2 photometric interpretation pixel format and graphic overlay with unsigned integer and 8 or 16 bits allocated. Accepted values:

Pixel plane

- Samples per Pixel (attribute 0028, 0002) = 1
- Photometric Interpretation (attribute 0028,0004) = “MONOCHROME1”
- Photometric Interpretation (attribute 0028,0004) = “MONOCHROME2”
- Pixel Representation (attribute 0028, 0103) = 0 (unsigned)
- Bits Allocated (attribute 0028, 0100) = 8, 16
- Bits Stored (attribute 0028,0101) = 8, 10, 12, 14, 15, 16
- High Bit (attribute 0028,0102) = bits stored - 1
- Aspect Ratio (attribute 0028,0034) only1:1 is supported

Overlay plane

- Overlay Type (attribute 60xx, 0040) = “G”
- Overlay Bits Allocated (attribute 60xx, 0100) = 16
- Overlay Bit Position (attribute 60xx, 0102) = 12, 13, 14, 15 (only bits above high bit permitted)
- Graphic Overlay will be shifted to fill Overlay Planes from Bit 12 and consecutive.

Overlay plane

- Overlay Type (attribute 60xx, 0040) = “G”
- Overlay Bits Allocated (attribute 60xx, 0100) = 1
- Overlay Bit Position (attribute 60xx, 0102) = 0
- Overlay Data (attribute 60xx, 3000) = supported.

The Biograph mCT DICOM application accepts also the MONOCHROME1 and MONOCHROME2 photometric interpretation pixel format with binary 2’s complement integer and 16 bits allocated. Accepted values:

Pixel plane

- samples per pixel (attribute 0028, 0002) = 1
- photometric interpretation (attribute 0028,0004) = “MONOCHROME1”
- photometric interpretation (attribute 0028,0004) = “MONOCHROME2”
- pixel representation (attribute 0028, 0103) = 1 (signed)
- bits allocated (attribute 0028, 0100) = 16
- bits stored (attribute 0028,0101) = 16
- high bit (attribute 0028,0102) = 15
- only aspect ratio (attribute 0028,0034) 1:1 is supported

Overlay plane

- overlay type (attribute 60xx, 0040) = “G”
- overlay bits allocated (attribute 60xx, 0100) = 1
- overlay bit position (attribute 60xx, 0102) = 0
- overlay data (attribute 60xx, 3000) = supported.

For MOD LUT both the linear LUT (Rescale Slope/Intercept) and the MOD LUT SQ are supported and considered when pixel data is displayed. However there are two limitations. The MOD LUT SQ will be ignored in the following cases:

- 8 bit signed pixels
- The pixel format is changed by the MOD LUT (e.g. 8 bit -> 16 bit).

If the MOD LUT SQ contains multiple LUTs then only the first one is used.

For VOI LUT also both the linear LUT (Window Center/Width) and the VOI LUT SQ are supported (VOI LUT SQ with 8 or 16 bit LUT data).

But if both a VOI LUT SQ and a linear MOD LUT are specified within one image, then the value of Rescale Slope is restricted to 1.

If the VOI LUT SQ contains multiple LUTs, then only the first one is used by default. The other VOI LUTs are selectable.

In this version the Display application supports only rectangular and circular Shutters. Images with other shutter types will be displayed without Shutter.

2.2.2.4.1.2.2 Image Pixel Attribute Acceptance Criterion for Color Images

The Siemens Display application supports the RGB color image description with the unsigned integer 24 bit color image plane pixel format. Accepted values:

- samples per pixel (attribute 0028, 0002) = 3
- photometric interpretation (attribute 0028,0004) = “RGB”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8
- bits stored (attribute 0028,0101) = 8
- high bit (attribute 0028,0102) = 7
- planar configuration (attribute 0028,0006) = 0 (pixel interleave) or 1 (plane interleave)

The Siemens Display application supports the “Palette Color” color image description with unsigned integer and 2’s complement pixel format:

- samples per pixel (attribute 0028, 0002) = 1
- photometric interpretation (attribute 0028,0004) = “PALETTE COLOR”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8 and bits stored (attribute 0028,0101) = 8
- bits allocated (attribute 0028, 0100) = 16 and bits stored (attribute 0028,0101) = 16
- high bit (attribute 0028,0102) = 7, 15

Both 8bit and 16bit palettes are supported - but no Segmented Palette Color LUTs.
The Siemens Display application supports the YBR_FULL color image description with the unsigned integer pixel format. Accepted values:

- samples per pixel (attribute 0028, 0002) = 3

- photometric interpretation (attribute 0028,0004) = ”YBR_FULL” or "YBR_FULL_422"
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8
- bits stored (attribute 0028,0101) = 8
- • high bit (attribute 0028,0102) = 7

If Biograph mCT software is making any persistent changes on a YBR image, the resulting new image will be saved with Photometric Interpretation "RGB".

2.2.3 Storage Commitment AE Specification

2.2.3.1 SOP Classes

The Biograph mCT DICOM application provides Standard Conformance to the DICOM V3.0 SOP Classes listed in Table 1: Network Services section "Storage Commitment" of the Conformance Statement Overview

2.2.3.2 Association Policy

2.2.3.2.1 General

With a Send Job successfully completed, the DICOM application will generate a Storage Commitment Identifier which references all instances of the processed job. The Commit Request is then sent over a single opened association. Biograph mCT will wait for Status responses of the Storage Commitment Request. If the Provider accepts the Storage Commitment with Success Status, the generated Transaction UID, together with study identification data and time stamp, is kept. Depending on configuration, the association is closed when the configured time out has elapsed or a response was received before. If the association is closed before a response was received, the response is then expected on a different association. Multiple Storage Commitment Requests can be pending.

The default PDU size will be 28 KB.

2.2.3.2.2 Number of Associations

The Biograph mCT DICOM application initiates several association at a time, one for each destination to which a transfer request is being processed in the active job queue list.

The Biograph mCT DICOM application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel.

2.2.3.2.3 Asynchronous Nature

The Biograph mCT DICOM application does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.3.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3: Implementation Identifying Information” in the “Conformance Statement Overview”.

2.2.3.3 Association Initiation Policy

The Biograph mCT Storage Commitment Application Entity acts as a SCU for the

- Storage Commitment Push Model Service Class (to request commitment for storage of instances previously sent)

To do so, Biograph mCT will issue a

- N-ACTION DIMSE to request commitment or a
- N-EVENT-REPORT DIMSE to respond to a received storage commitment request and the association was closed by the remote system prior to response.

2.2.3.3.1 Activity – Send Storage Commit Request

The Biograph mCT Storage Commitment application sends the commit request (N-ACTION_RQ) message and waits for acceptance of this request (N_ACTION-RSP). After receiving this, the transaction is marked as "waiting".

Depending on a configuration value, the association will then be closed or kept open. In the first case there is another configurable timeout giving the number of hours (h) and minutes (m) (by default 1h:0m) to wait for the corresponding commit response (N_EVENT-REPORT). In the second case, this time is the (also configurable) time out for the association. For both cases, if the commit response (N-EVENT-REPORT) does not arrive during the configured time, the transaction will be marked as failed. Biograph mCT does not re-send objects because of a failed Storage Commitment result in any case.

If the commit response (N-EVENT-REPORT) received has the status of "complete - failure exists", the transaction is marked as failed, else the transaction is marked as "completed"; in both cases, a message is shown to the user.

2.2.3.3.1.1 Proposed Presentation Contexts

The Biograph mCT Storage Commitment AE will propose Presentation Contexts as shown in the following table:

Table 7: Proposed Presentation Context for Storage Commitment Request

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.1		

2.2.3.3.1.2 SOP specific Conformance for SOP classes

Storage Commitment is supported for all the SOP class UIDs as mentioned in *'Acceptable presentation contexts Storage'*.

The Referenced Study Component Sequence is not supported.

Storage Media File-Set ID and UID Attributes will not be supported in the commitment request (N-ACTION primitive) invoked by the Storage Commitment SCU.

2.2.3.4 Association Acceptance Policy

The Biograph mCT Storage Commitment AE accepts an association in this case: when acting as SCU if configured to receive N-EVENT-REPORT on a separate association.

Activity – Receive Storage Commitment Response

The Biograph mCT Storage Commitment AE has sent a Storage Commitment Request and, being configured to receive response on a separate association, has closed the association, and now it gets an association request from the Storage Commitment SCP that wants to send the results. The application will wait for Storage Commitment Notification triggers. Any incoming notification will be checked for validity, that is, if the related Transaction UID is still part of the Pending Request Queue.

If the Notification is valid, the Notification Identifier is evaluated and the related Instances marked with the related status. The overall Commit Status of the higher Information Entities is derived from propagation of all Image entities included in a study.

The status flags directly affected by Storage Commitment results and indicated in the different entities of the Patient Browser list can be one of (English UI assumed):

- "AC" or "SC" - Successful Commitment. A means archived to configured archive destination, whereas S means sent to any other destination.
- "Af" or "Sf" - Commitment failed
- "A?" or "S?" - Commitment request is sent, response is pending

In case of failure the user has to repeat the transfer of images to the Archive destination. Another Storage Commitment will be performed after sending is completed successfully.

2.2.3.4.1.1 Accepted Presentation Contexts

The Biograph mCT Storage Commitment AE will accept Presentation Contexts as shown in the following table:

Table 8: Accepted Presentation Context for Storage Commitment Response

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.1		

2.2.3.4.1.2 SOP specific Conformance for SOP classes

If the Commitment Response (N_EVENT_REPORT) received has the status of "complete - failure exists", the transaction is marked as failed, else the transaction is marked as "completed"; In both cases, a message is shown to the user.

The related status flags are set for the committed images in the local database.

The Biograph mCT DICOM application will NOT support the Storage Media File Set ID attributes.

2.2.4 Query/Retrieve AE Specification

The Query/Retrieve SCU requests that the remote SCP performs a match of all keys specified in the request against the information in its database and the identified images will be moved over a different (C-MOVE) storage association.

The Query/Retrieve SCP responds to queries based on the records of its database and images will be sent to the requesting SCU or to a different storage destination.

2.2.4.1 SOP Classes

The Biograph mCT DICOM application provides Standard Conformance to the following DICOM V3.0 SOP Classes listed in “Table 1: Network Services” section "Query/Retrieve" of the Conformance Statement Overview.

Note: See also the Storage DICOM Conformance Statement Association Acceptance Policy2.2.1.4 to compare for conformance of the C-STORE sub-operation generated by the C-MOVE and C-GET DIMSE services. Furthermore,

compare the supported Storage Service SOP classes described in the Storage DICOM Conformance Statement of the Modality to which the images shall be transferred to.

2.2.4.2 Association Policy

2.2.4.2.1 General

With the "Search..." function the query data are entered and the DICOM Query/Retrieve application is started. A query request will be sent out to one remote node that can be selected from a list of configured Query Providers and the response data will be displayed for the user. In order to provide detailed information early additional queries are sent for the more detailed levels not yet covered by the first results. Upon request (Import), the retrieval of selected items is initiated.

The default PDU size used will be 28 KB.

2.2.4.2.2 Number of Associations

The Biograph mCT DICOM Query/Retrieve application initiates several association at a time, one for each query/retrieve request being processed.

The Biograph mCT DICOM Query/Retrieve application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel

2.2.4.2.3 Asynchronous Nature

The Biograph mCT DICOM Query/Retrieve application does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.4.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3: Implementation Identifying Information” in the “Conformance Statement Overview”.

2.2.4.3 Association Initiation Policy

The Query/Retrieve user interface will request the query data from the user and triggers C-FIND requests to the selected remote node. The response data will be displayed in the query UI for further data navigation.

When requesting Import of related items the browser requests the retrieve application to send a C_MOVE request to the related remote node. Images will then be received by the Storage SCP as described in the related section.

The following DIMSE-C operations are supported as SCU:

- C-FIND
- C-MOVE

2.2.4.3.1 Activity – FIND SCU

The associated Real-World activity is to fill out a query form with search data and pass it as queries to the network application which issues a C-FIND over a previously built association. The remote SCP will respond with related data entries that will be passed to a browser application. When data transfer is finished the association is closed.

2.2.4.3.1.1 Proposed Presentation Contexts

The Biograph mCT DICOM Query application will propose Presentation Contexts as shown in the following table

Table 9: Proposed Presentation Contexts - Find SCU

Abstract Syntax	Transfer Syntax	Role	Extended

Name	UID	Name List	UID List		Negotiation
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient Study only Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

It is configurable which of the three query models are to be used by the Biograph mCT Query SCU application. If Patient and Study Root Abstract Syntaxes are configured, the C_FIND SCU will use the Patient Root Model only for C-FIND requests on PATIENT level. For all other levels it will use the STUDY Root Model.

It is highly recommended to configure only the Study Root Model if the corresponding Query SCP supports this Model. If the Query SCP does not support queries on Series Level, Patient Study Only Model should be used.

2.2.4.3.1.2 SOP specific Conformance for SOP classes

The Biograph mCT DICOM Query/Retrieve SCU supports hierarchical queries with all mandatory search keys. On each level, the unique attributes of all previous levels are also sent (values are provided by the user by selection from a list). For instance for a query using the patient root model on Series level, the Patient ID of the current selected patient and the Study Instance UID of the current selected study are included in the message. The interactive querying of attributes on IMAGE level is not supported by the Query SCU. Nevertheless, retrieval of individual Objects is possible.

The Query dialog in Biograph mCT offers search keys on different levels (Patient, Study, Series). Depending on the used Query Model (Patient Root, Study Root, Patient Study Only) the Biograph mCT DICOM Query/Retrieve SCU will execute multiple queries sequentially.

E.g. Patient Root Model:

The first query is performed on patient level with the entered patient level query keys. For each query result a new query is performed on study level with the entered study level query keys. At last for each result on study level a query is performed on series level with the entered series level keys.

The Table 10 describes the search keys for the three query models (Patient Root, Study Root, Patient Study Only) that the Biograph mCT Query/Retrieve application supports as an SCU. Matchings are either wildcard, which means that the user can supply a string containing wildcards, or universal, which means that the attribute is returned no matter what value it has.

Table 10: Query attributes:

Attribute name	Tag	Type	Matching	user input	return value displayed
Patient level[2]					
Patient name	(0010,0010)	R	wildcard[d]	enter value	yes
Patient ID	(0010,0020)	U	wildcard[d]	enter value	yes
Patient's birth date	(0010,0030)	O	universal (NULL)	enter value	yes
Patient's sex	(0010,0040)	O	universal (NULL)	enter value	yes
Number of Patient related studies	(0020,1200)	O	universal (NULL)	-	yes[3]
Number of Patient relates series	(0020,1202)	O	universal (NULL)	-	no
Number of Patient related instances	(0020,1204)	O	universal (NULL)	-	no
Study level					
Patient name[4]	(0010,0010)	R	wildcard[5]	enter value	yes
Patient ID	(0010,0020)	R	wildcard[6]	enter value	yes
Patient's birth date[c]	(0010,0030)	O	universal (NULL)	enter value	yes
Patient's sex[c]	(0010,0040)	O	universal (NULL)	enter value	yes
Study Instance UID	(0020,000D)	U	single value	-	no
Study ID	(0020,0010)	R	universal (NULL)	enter value[d]	yes
Study date	(0008,0020)	R	universal (NULL)	enter value[7]	yes
Study time	(0008,0030)	R	universal (NULL)	-	yes
Accession number	(0008,0050)	R	universal (NULL)	enter value[d]	yes
Study description	(0008,1030)	O	universal (NULL)	enter value[d]	yes

[2] Only for Patient Root or Patient Study Only information model
[3] Implicitly visualized in the UI if no study and series search attributes have been entered
[4] Only for Study Root information model
[5] Always a "*" is added to the string supplied by the user
[6] Always a "*" is added to the string supplied by the user
[7] Date range possible

Attribute name	Tag	Type	Matching	user input	return value displayed
Referring physician's name	(0008,0090)	O	universal (NULL)	enter value[d]	yes
Name of physician reading study	(0008,1060)	O	universal (NULL)	enter value[d]	yes
Modalities in Study	(0008,0061)	O	universal (NULL)	enter value[d]	yes
Storage Media File Set ID	(0008,0130)	O	universal (NULL)	-	no
Retrieve AE Title	(0008,0054)	O	universal (NULL)	-	no
Number of study related series	(0020,1206)	O	universal (NULL)	-	yes[8]
Number of study related instances	(0020,1208)	O	universal (NULL)	-	no
Series level					
Series instance UID	(0020,000E)	U	single value	-	no
Series number	(0020,0011)	R	universal (NULL)	-	yes
Modality	(0008,0060)	R	universal (NULL)	enter value	yes
Series date	(0008,0021)	O	universal (NULL)	-	yes
Series time	(0008,0031)	O	universal (NULL)	-	yes
Study ID	(0020,0010)	O	universal (NULL)	-	yes
Series description	(0008,103E)	O	universal (NULL)	enter value[d]	yes
Storage Media File Set ID	(0008,0130)	O	universal (NULL)	-	yes
Retrieve AE Title	(0008,0054)	O	universal (NULL)	-	yes
Body Part Examined	(0018,0015)	O	universal (NULL)	enter value[d]	yes
Protocol name	(0018,1030)	O	universal (NULL)	-	no
Performing Physician	(0018,1050)	O	universal (NULL)	enter value[d]	yes

[8] Implicitly visualized in the UI if no series search attributes have been entered

Attribute name	Tag	Type	Matching	user input	return value displayed
Performed procedure step start date	(0040,0244)	O	universal (NULL)	-	yes
Performed procedure step start time	(0040,0245)	O	universal (NULL)	-	yes
Request Attribute Sequence	(0040,0275)	O	universal (NULL)	-	yes
>Requested Procedure ID	(0040,1001)	O	universal (NULL)	-	yes
>Scheduled Procedure ID	(0040,0009)	O	universal (NULL)	-	yes
Number of series related instances	(0020,1209)	O	universal (NULL)	-	yes
Image Level					
SOP Instance UID	(0008,0018)	U	single value	-	no
Instance Number	(0020,0013)	R	universal (NULL)	-	yes
Storage Media File Set ID	(0008,0130)	O	universal (NULL)	-	no
Retrieve AE Title	(0008,0054)	O	universal (NULL)	-	no
Content date	(0008,0023)	O	single value, range matching, universal	enter value	yes
Content time	(0008,0033)	O	single value, range matching, universal	enter value	yes
Number of Frames	(0028,0008)	O	universal (NULL)	-	yes
Image comments	(0020,4000)	O	universal (NULL)	-	no
Referenced Request Sequence	(0040,A370)	O	sequence matching	-	yes
> Accession Number	(0008,0050)	O	single value, universal	-	yes
> Requested Procedure ID	(0040,1000)	O	single value, universal	-	yes
Concept Name Code Sequence	(0040,A043)	O	sequence matching	enter value	yes

Attribute name	Tag	Type	Matching	user input	return value displayed
> Code Value	(0008,0100)	O	single value, universal, wildcard	-	yes
> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard	-	yes
> Coding Scheme Version	(0008,0103)	O	single value, universal, wildcard	-	yes
> Code Meaning	(0008,0104)	O	single value, universal, wildcard	-	yes
Template Identifier	(0040,DB00)	O	single value, universal, wildcard	-	yes
Completion Flag	(0040,A491)	O	single value, universal, wildcard	enter value	yes
Verification Flag	(0040,A493)	O	single value, universal, wildcard	enter value	yes
Verifying Observer Sequence	(0040,A073)	O	sequence matching	enter value	yes
> Verifying Organization	(0008,A072)	O	single value, universal, wildcard	-	yes
> Verifying DateTime	(0008,A030)	O	single value, range matching, universal	enter value	yes
> Verifying Observer Name	(0008,A075)	O	single value, universal, wildcard	enter value	yes
> Verifying Observer Identification Code Sequence	(0040,A088)	O	sequence matching		yes
>> Code Value	(0008,0100)	O	single value, universal, wildcard	-	yes
>> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard	-	yes
>> Coding Scheme Version	(0008,0103)	O	single value, universal,	-	yes

Attribute name	Tag	Type	Matching	user input	return value displayed
			wildcard		
>> Code Meaning	(0008,0104)	O	single value, universal, wildcard	-	yes

The Find SCU interprets following status codes:

Table 11: C-FIND Response Status

Service Status	Meaning	Protocol Codes	Related Fields
Success	Matching is complete - No final Identifier is supplied	0000	None
Failed	Out of Resources	A700	(0000,0902)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

2.2.4.3.2 Activity – MOVE SCU

The operator selects a data entry in the Query UI and activates the "Import" function.

This will generate a retrieval request to the archival application which issues a C-MOVE service according to the Patient Root or Study Root query model. (The Storage Service Class Conformance Statement of the SCP describes the C-STORE service which is generated by processing the C-MOVE service.)

The transferred image data are processed as described in the storage class SCP descriptions.

The possibility to request the remote C-MOVE provider to move data to an application entity other than the C-MOVE SCU (the Biograph mCT DICOM application) is NOT used.

2.2.4.3.2.1 Proposed Presentation Contexts

The Biograph mCT DICOM application will propose Presentation Contexts as shown in the following table:

Table 12: Proposed Presentation Contexts – Move SCU

Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
Patient Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient Study only Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note:
C-MOVE Extended Negotiation will be NOT supported by the SCU.

C-MOVE on Patient level is not supported by the application.

2.2.4.3.2.2 SOP specific Conformance for SOP classes

At association establishment time the C-MOVE presentation context shall be negotiated. The C-STORE sub-operations must be done on a different association to transfer images to the own Storage Service Class SCP.

The Move SCU interprets following status codes:

Table 13: C-MOVE response status

Service Status	Meaning	Protocol Codes	Related Fields
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

Failed	Out of Resources - Unable to calculate number of matches Out of Resources - Unable to perform sub operations	A701 A702	(0000,0902) (0000,1020) (0000,1021) (0000,1022) (0000,1023)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

2.2.4.4 Association Acceptance Policy

The Query/Retrieve SCU and SCP establish an association by using the DICOM association services. During association establishment the Query/Retrieve application entities negotiate the supported SOP classes to exchange the capabilities of the SCU and the SCP.

The following DIMSE-C operations are supported as SCP:

- C-FIND
- C-GET
- C-MOVE
- C-FIND-CANCEL
- C-GET-CANCEL
- C-MOVE-CANCEL

2.2.4.4.1 Activity – FIND SCP

The associated Real-World activity is to respond to query requests to an SCU with the query model Patient Root, Study Root and Patient/Study Only. Relational retrieve operation is NOT supported. With a C-FIND-CANCEL request the running query can be cancelled at any time.

The SCP does support multiple C-FIND-requests over the same association, but not multiple C-MOVE requests.

2.2.4.4.1.1 Accepted Presentation Contexts

The Biograph mCT Query/Retrieve AE will accept Presentation Contexts as shown in the following table

Table 14: Accepted Presentation Contexts - Find SCP

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient/Study Only Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note

C-FIND Extended Negotiation will NOT be supported by the SCP.

The order of preference in accepting a Transfer syntax is:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

2.2.4.4.1.2 SOP specific Conformance for SOP classes

The Biograph mCT DICOM Query/Retrieve SCP supports hierarchical queries with all mandatory and optional search keys.

The following six notes apply to the handling of attribute Patient's Name (0010,0010) as Query/Retrieve SCP. The syntactical structure of Patient's Name (0010,0010) attribute is as follows:

<single byte group>=<ideographic group>=<phonetic group>

Each group may have up to five components, which are separated by carets"^".

1. Matching of Patient's Name attribute (0010,0010) is done case-insensitive.
2. If a search string matches the complete value of a data base object's Patient's Name, a match will be returned.
3. If a search string matches an individual group (single byte, ideographic or phonetic) of a data base object's Patient's Name, a match will be returned.
4. If a search string matches two consecutive groups of a data base object's Patient's Name, a match will be returned.
5. Redundant group separators "=" or component separators "^" are treated as insignificant for matching.
6. Leading and trailing blanks within a component or a group of Patient's Name (0010,0010) are treated as insignificant for matching.

Except for the attribute Patient's Name (0010,0010) any other query attribute contents will be treated Case Sensitive.

With wildcard queries the symbol "?" is treated as "*" by the C-FIND-SCP application. As a consequence the query string of "?abc*" will be processed as "*abc*".

If the value for the patient level unique key "Patient ID" is not known, it may be returned with zero length. The attribute "Image Comments" will not be included in the C-FIND-RSP, if it is not set in the DB, even if it was requested as return key in the related C-FIND-RQ.

Usage of Storage Media File Set ID, Retrieve AE Title with C-FIND-RSP message:

- The C-FIND SCP may return the DICOM attributes StorageMediaFileSetID (0088,0130) and StorageMediaFileSetUID (0088,0140) as empty or not at all. The Storage Media File Set ID - if existent - can be returned at Study/Series/Image Level. Only on Image Level, the values of ONLINE, NEARLINE or OFFLINE are returned to indicate the Storage Location of the related instance.
- The C-FIND SCP may return the DICOM attributes Retrieve AE Title (0008,0054) as empty or not at all. The Retrieve AE Title - if existent - can only be returned at Image Level (for Patient Root and Study Root models) or Study Level (for Patient/Study Only model).

Relational Queries are NOT supported.

A remote DICOM AE can cancel the running query by sending a C-FIND-CANCEL. Matches are possibly continuing (more C-FIND response with status PENDING) until the cancel operation has completed.

The supported attributes on the various levels of the three information models are listed in the tables of the following sections.

2.2.4.4.1.2.1 Patient Root Information Model

Table 15: Patient Level Attributes, Patient Root Information Model

Attribute name	Tag	Type	Matching
Patient name	(0010,0010)	R	single value, wildcard, universal
Patient id	(0010,0020)	U	single value, wildcard, universal
Patient's birth date	(0010,0030)	O	single value, range, universal
Patient's birth time	(0010,0032)	O	single value, range, universal
Patient's sex	(0010,0040)	O	single value, wildcard, universal
Ethnic group	(0010,2160)	O	single value, wildcard, universal
Patient comments	(0010,4000)	O	wildcard, universal
Number of Patient related studies	(0020,1200)	O	universal
Number of Patient relates series	(0020,1202)	O	universal
Number of Patient related instances	(0020,1204)	O	universal

Table 16: Study level attributes, Patient Root Information Model

Attribute name	Tag	Usage SCU	Matching
Study instance UID	(0020,000D)	U	single value, list of UIDs
Study id	(0020,0010)	R	single value, wildcard, universal
Study date	(0008,0020)	R	single value, range, universal
Study time	(0008,0030)	R	single value, range, universal
Accession number	(0008,0050)	R	single value, wildcard, universal
Referring physician's name	(0008,0090)	O	single value, wildcard, universal
Study description	(0008,1030)	O	single value, wildcard, universal
Admitting diagnoses description	(0008,1080)	O	single value, wildcard, universal
Patient's age	(0010,1010)	O	single value, wildcard, universal
Patient's size	(0010,1020)	O	single value, universal
Patient's weight	(0010,1030)	O	single value, universal
Additional patient history	(0010,21B0)	O	wildcard, universal
Name of physician reading study	(0008,1060)	O	single value, wildcard, universal
Modalities in Study	(0008,0061)	O	multiple values, universal
Number of study related series	(0020,1206)	O	universal
Number of study related instances	(0020,1208)	O	universal

Table 17: Series level attributes, Patient Root Information Model

Attribute name	Tag	Usage SCU	Matching
Series instance UID	(0020,000E)	U	single value, list of UID
Series number	(0020,0011)	R	single value, universal
Modality	(0008,0060)	R	single value, wildcard, universal

Laterality	(0020,0060)	O	single value, wildcard, universal
Body part examined	(0018,0015)	O	single value, wildcard, universal
Patient position	(0018,5100)	O	single value, wildcard, universal
Smallest pixel value in series	(0028,0108)	O	single value, universal
Largest pixel value in series	(0028,0109)	O	single value, universal
Protocol name	(0018,1030)	O	single value, wildcard, universal
Series date	(0008,0021)	O	single value, range, universal
Series time	(0008,0031)	O	single value, range, universal
Series description	(0008,103E)	O	single value, wildcard, universal
Operators name	(0008,1070)	O	single value, wildcard, universal
Performing physician's name	(0008,1050)	O	single value, wildcard, universal
Performed procedure step start date	(0040,0244)	O	universal
Performed procedure step start time	(0040,0245)	O	universal
Number of series related instances	(0020,1209)	O	universal
Referenced request sequence	(0040,A370)	O	sequence matching
>Requested Procedure ID	(0040,1001)	O	single value, universal

Table 18: Image level attributes, Patient Root Information Model

Attribute name	Tag	Usage SCU	Matching
SOP instance UID	(0008,0018)	U	single value, list of UID
SOP class UID	(0008,0016)	U	single value
Instance number	(0020,0013)	R	single value, universal
Content date	(0008,0023)	O	single value, range, universal
Content time	(0008,0033)	O	single value, range, universal

Modality	(0008,0060)	O	single value, wildcard, universal
Image comments	(0020,4000)	O	universal
Referenced Request Sequence	(0040,A370)	O	sequence matching
> Accession Number	(0008,0050)	O	single value, universal
> Requested Procedure ID	(0040,1000)	O	single value, universal
Concept Name Code Sequence	(0040,A043)	O	sequence matching
> Code Value	(0008,0100)	O	single value, universal, wildcard
> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard
> Coding Scheme Version	(0008,0103)	O	single value, universal, wildcard
> Code Meaning	(0008,0104)	O	single value, universal, wildcard
Template Identifier	(0040,DB00)	O	single value, universal, wildcard
Completion Flag	(0040,A491)	O	single value, universal, wildcard
Verification Flag	(0040,A493)	O	single value, universal, wildcard
Verifying Observer Sequence	(0040,A073)	O	sequence matching
> Verifying Organization	(0008,A072)	O	single value, universal, wildcard
> Verifying DateTime	(0008,A030)	O	single value, range matching, universal
> Verifying Observer Name	(0008,A075)	O	single value, universal, wildcard
> Verifying Observer Identification Code Sequence	(0040,A088)	O	sequence matching
>> Code Value	(0008,0100)	O	single value, universal, wildcard
>> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard
>> Coding Scheme Version	(0008,0103)	O	single value, universal, wildcard
>> Code Meaning	(0008,0104)	O	single value, universal, wildcard

2.2.4.4.1.2.2 Study Root Information Model

Table 19: Study level attributes, Study Root Information Model

Attribute name	Tag	Usage SCU	Matching
Patient name	(0010,0010)	R	single value, wildcard, universal

Patient id	(0010,0020)	R	single value, wildcard, universal
Patient's birth date	(0010,0030)	O	single value, range, universal
Patient's birth time	(0010,0032)	O	single value, range, universal
Patient's sex	(0010,0040)	O	single value, wildcard, universal
Patient comments	(0010,4000)	O	wildcard, universal
Number of Patient related studies	(0020,1200)	O	universal
Number of Patient relates series	(0020,1202)	O	universal
Number of Patient related instances	(0020,1204)	O	universal
Study instance UID	(0020,000D)	U	single value, list of UIDs
Study id	(0020,0010)	R	single value, wildcard, universal
Study date	(0008,0020)	R	single value, range, universal
Study time	(0008,0030)	R	single value, range, universal
Accession number	(0008,0050)	R	single value, wildcard, universal
Referring physician's name	(0008,0090)	O	single value, wildcard, universal
Study description	(0008,1030)	O	single value, wildcard, universal
Admitting diagnoses description	(0008,1080)	O	single value, wildcard, universal
Patient's age	(0010,1010)	O	single value, wildcard, universal
Patient's size	(0010,1020)	O	single value, universal
Patient's weight	(0010,1030)	O	single value, universal
Occupation	(0010,2180)	O	single value, wildcard, universal
Additional patient history	(0010,21B0)	O	wildcard, universal
Name of physician reading study	(0008,1060)	O	single value, wildcard, universal
Modalities in Study	(0008,0061)	O	multiple values, universal
Number of study related series	(0020,1206)	O	universal
Number of study related instances	(0020,1208)	O	universal

Table 20: Series level attributes, Study Root Information Model

Attribute name	Tag	Usage SCU	Matching
Series instance UID	(0020,000E)	U	single value, list of UID
Series number	(0020,0011)	R	single value, universal
Modality	(0008,0060)	R	single value, wildcard, universal
Laterality	(0020,0060)	O	single value, wildcard, universal
Body part examined	(0018,0015)	O	single value, wildcard, universal
Patient position	(0018,5100)	O	single value, wildcard, universal
Smallest pixel value in series	(0028,0108)	O	single value, universal
Largest pixel value in series	(0028,0109)	O	single value, universal
Protocol name	(0018,1030)	O	single value, wildcard, universal
Series date	(0008,0021)	O	single value, range, universal
Series time	(0008,0031)	O	single value, range, universal
Series description	(0008,103E)	O	single value, wildcard, universal
Operators name	(0008,1070)	O	single value, wildcard, universal
Performing physician's name	(0008,1050)	O	single value, wildcard, universal
Performed procedure step start date	(0040,0244)	O	universal
Performed procedure step start time	(0040,0245)	O	universal
Number of series related instances	(0020,1209)	O	universal

Table 21: Image level attributes, Study Root Information Model

Attribute name	Tag	Usage SCU	Matching
SOP instance UID	(0008,0018)	U	single value, list of UID

SOP class UID	(0008,0016)	U	single value,
Instance number	(0020,0013)	R	single value, universal
Content date	(0008,0023)	O	single value, range, universal
Content time	(0008,0033)	O	single value, range, universal
Modality	(0008,0060)	O	single value, wildcard, universal
Image comments	(0020,4000)	O	universal
Referenced Request Sequence	(0040,A370)	O	sequence matching
> Accession Number	(0008,0050)	O	single value, universal
> Requested Procedure ID	(0040,1000)	O	single value, universal
Concept Name Code Sequence	(0040,A043)	O	sequence matching
> Code Value	(0008,0100)	O	single value, universal, wildcard
> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard
> Coding Scheme Version	(0008,0103)	O	single value, universal, wildcard
> Code Meaning	(0008,0104)	O	single value, universal, wildcard
Template Identifier	(0040,DB00)	O	single value, universal, wildcard
Completion Flag	(0040,A491)	O	single value, universal, wildcard
Verification Flag	(0040,A493)	O	single value, universal, wildcard
Verifying Observer Sequence	(0040,A073)	O	sequence matching
> Verifying Organization	(0008,A072)	O	single value, universal, wildcard
> Verifying DateTime	(0008,A030)	O	single value, range matching, universal
> Verifying Observer Name	(0008,A075)	O	single value, universal, wildcard
> Verifying Observer Identification Code Sequence	(0040,A088)	O	sequence matching
>> Code Value	(0008,0100)	O	single value, universal, wildcard
>> Coding Scheme Designator	(0008,0102)	O	single value, universal, wildcard
>> Coding Scheme Version	(0008,0103)	O	single value, universal, wildcard
>> Code Meaning	(0008,0104)	O	single value, universal, wildcard

2.2.4.4.1.2.3 Patient Study Only Information Models

Table 22: Patient instance level, Patient Study Only Information Model

Attribute name	Tag	Usage SCU	Matching
Patient name	(0010,0010)	R	single value, wildcard, universal
Patient id	(0010,0020)	U	single value, wildcard, universal
Patient's birth date	(0010,0030)	O	single value, range, universal
Patient's birth time	(0010,0032)	O	single value, range, universal
Patient's sex	(0010,0040)	O	single value, wildcard, universal
Ethnic group	(0010,2160)	O	single value, wildcard, universal
Patient comments	(0010,4000)	O	wildcard, universal
Number of Patient related studies	(0020,1200)	O	universal
Number of Patient relates series	(0020,1202)	O	universal
Number of Patient related instances	(0020,1204)	O	universal

Table 23: Study level attributes, Patient Study Only Information Model

Attribute name	Tag	Usage SCU	Matching
Study instance UID	(0020,000D)	U	single value, list of UIDs
Study id	(0020,0010)	R	single value, wildcard, universal
Study date	(0008,0020)	R	single value, range, universal
Study time	(0008,0030)	R	single value, range, universal
Accession number	(0008,0050)	R	single value, wildcard, universal
Referring physician's name	(0008,0090)	O	single value, wildcard, universal
Study description	(0008,1030)	O	single value, wildcard, universal
Admitting diagnoses description	(0008,1080)	O	single value, wildcard, universal
Patient's age	(0010,1010)	O	single value, wildcard, universal
Patient's size	(0010,1020)	O	single value, universal

Patient's weight	(0010,1030)	O	single value, universal
Occupation	(0010,2180)	O	single value, wildcard, universal
Additional patient history	(0010,21B0)	O	wildcard, universal
Name of physician reading study	(0008,1060)	O	single value, wildcard, universal
Modalities in Study	(0008,0061)	O	multiple values, universal
Number of study related series	(0020,1206)	O	universal
Number of study related instances	(0020,1208)	O	universal

Note:
The C-FIND-RSP message will contain the following attributes:

- Specific Character Set (0008,0005) (If there is a specific character set in use)
- Query/Retrieve Level (0008,0052) from the C_FIND_RQ
- Retrieve AE Title (0008,0054) at study, series and image level.

This value is a list of AE titles from which the images can be retrieved. Will be NULL except for the lowest level of the query model (Image level for Patient Root or Study Root and Study level for Patient/Study Only)

- Storage-Media File-set ID (0088,0130) at level study, series and image. If Storage-Media File-set ID is not present a NULL value will be returned.
- attributes requested by C_FIND_RQ and supported by the SCP

The Find SCP returns following status codes:

Table 24: C-FIND return status

Service Status	Meaning	Protocol Codes	Related Fields
Success	Matching is complete - No final Identifier is supplied	0000	None
Failed	Out of Resources	A700	(0000,0902)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier

	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

2.2.4.4.2 Activity – GET SCP

The associated Real-World activity is to respond to retrieve requests initiated from a foreign SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Statement describes the C-STORE service which is generated by C-GET service. Relational retrieve operation is NOT supported.

Multiple C-GET requests over the same association are NOT supported.

2.2.4.4.2.1 Accepted Presentation Contexts

The Biograph mCT DICOM application will propose Presentation Contexts as shown in the following table:

Table 25: Proposed Presentation Contexts -- Get SCP

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model - GET	1.2.840.10008.5.1.4.1.2.1.3	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Model - GET	1.2.840.10008.5.1.4.1.2.2.3	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient/Study Only Query/Retrieve Model - GET	1.2.840.10008.5.1.4.1.2.3.3	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note
C-GET Extended Negotiation will be NOT supported by the SCP.

The order of preference in accepting a Transfer syntax is:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

2.2.4.4.2.2 SOP specific Conformance for SOP classes

At association establishment time the C-GET presentation context must be negotiated along with the C-STORE sub-operations which must be accomplished on the same association as the C-GET operation. Relational retrieve operation is NOT supported.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about "U" marked key attributes.

Note:

In DICOM wildcard queries the symbol '?' is treated as '*' by Find SCP. So a wildcard query with "?abc*" is actually treated as "*abc*"

The Get SCP returns following status codes:

Table 26: C-GET Return Status

Service Status	Meaning	Protocol Codes	Related Fields
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Out of Resources - Unable to calculate number of matches Out of Resources - Unable to perform suboperations	A701 A702	(0000,0902) (0000,1020) (0000,1021) (0000,1022) (0000,1023)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

2.2.4.4.3 Activity – MOVE SCP

The associated Real-World activity is to respond to retrieve requests to an SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Statement describes the C-STORE service which is generated by the C-MOVE service. Relational retrieve operation is NOT supported.

Multiple C-MOVE requests over the same association are NOT supported

2.2.4.4.3.1 Accepted Presentation Contexts

The Biograph mCT DICOM application will propose Presentation Contexts as shown in the following table:

Table 27: Proposed Presentation Contexts -- Get SCP

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Patient/Study Only Query/Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCP	See Note
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

Note

C-MOVE Extended Negotiation will be NOT supported by the SCP.

The order of preference in accepting a Transfer syntax is:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

2.2.4.4.3.2 SOP specific Conformance for SOP classes

At association establishment time the C-MOVE presentation context shall be negotiated. The C-STORE sub-operations is done on a different association, specified in the C-MOVE request, to transfer images to another SCP of the Storage Service Class. Relational retrieve operation is NOT supported.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about "U" marked key attributes.

Note:

In DICOM wildcard queries the symbol '?' is treated as '*' by Find SCP. So a wildcard query with "?abc*" is actually treated as "*abc*"

The Move SCP returns following status codes:

Table 28: C-MOVE Return Status

Service Status	Meaning	Protocol Codes	Related Fields
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Out of Resources - Unable to calculate number of matches Out of Resources - Unable to perform suboperations	A701 A702	(0000,0902) (0000,1020) (0000,1021) (0000,1022) (0000,1023)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

2.2.5 Print Specification

The print management SCU (HCS) invokes print management DIMSE services to transfer images from the local AE to the remote SCP AE to print the images with the defined film format and size on a selected network DICOM hardcopy printer. See DICOM part 4 annex H. This is done in a "full-page" print mode.

2.2.5.1 SOP Classes

Biograph mCT DICOM implementation provides Standard Conformance to the following DICOM V3.0 Basic Grayscale Print Management Meta SOP Classes as an SCU:

Table 29: Basic Gray Scale Print Management Meta SOP-Classes

SOP Class Name	SOP Class UID

Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
+ Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
+ Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
+ Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
+ Printer SOP Class	1.2.840.10008.5.1.1.16
+ Print Job SOP Class	1.2.840.10008.5.1.1.14
+ Presentation LUT SOP Class	1.2.840.10008.5.1.1.23

Table 30: Basic Color Print Management Meta SOP-Classes

SOP Class Name	SOP Class UID
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
+ Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
+ Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
+ Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
+ Printer SOP Class	1.2.840.10008.5.1.1.16
+ Print Job SOP Class	1.2.840.10008.5.1.1.14

2.2.5.2 Association Policy

2.2.5.2.1 General

Whenever a film is completely set up and printed by command or automatism, the job is prepared for processing. As soon as the queue is ready to process the job is activated and carried out according to the processing data. The related Print application will initiate an association to the print destination and process the printing of the related information.

The default PDU size will be 28 KB.

2.2.5.2.2 Number of Associations

The Biograph mCT DICOM Print application initiates one association at a time for print device configured.

2.2.5.2.3 Asynchronous Nature

The Biograph mCT DICOM implementation does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.5.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3: Implementation Identifying Information” in the “Conformance Statement Overview”.

2.2.5.3 Association Initiation Policy

Triggered by the Print job queue the Print Management SCU establishes an association by using the DICOM association services. With the help of the N-GET request for the printer SOP Class the Status is determined before printing.

In case no problem is encountered with the N-CREATE/N-SET Services for the related Basic Print SOP Classes the film sheet is set up for printing and the image(s) is(are) transferred to the printer device.

After the last film is printed from the queue, the Print application will leave open the association for another 60 seconds. If a new film job is ready for printing within this time limit, the job will be processed immediately over the

association still open. If there is no new job, the association is closed when the time out has elapsed. This is done to optimize automatic printing.

During the "idle time" (no open association to printer) the Print application will issue a cyclic camera status request (using N-GET of Printer SOP Class) every 5 minutes.

2.2.5.3.1 Activity – Printing a Printer Job Queue Entry

Whenever a film sheet is prepared by the user, it is forwarded to the Printer Job queue. As soon as the associated Printer device is available the job is activated and an association is set up.

The film sheet is internally processed, converted to a Standard/1-1 page and then the page image is sent. Status is controlled by awaiting any N-EVENT message all through the transfer until the last image or film sheet is sent.

If the response from the remote application contains a status other than Success or Warning the association is aborted.

2.2.5.3.1.1 Proposed Presentation Contexts

The Biograph mCT DICOM application will propose Presentation Contexts as shown in the following table:

Table 31: Presentation context - Print SCU

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Basic Color Print Management Meta SOP class	1.2.840.10008.5.1.1.18	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Basic film session SOP class	1.2.840.10008.5.1.1.1	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Basic film box SOP class	1.2.840.10008.5.1.1.2	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Basic grayscale image box SOP class	1.2.840.10008.5.1.1.4	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

Basic color image box SOP class	1.2.840.10008.5.1.1.4.1	DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Printer SOP class	1.2.840.10008.5.1.1.16	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Print Job SOP class	1.2.840.10008.5.1.1.14	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		
Presentation LUT SOP class	1.2.840.10008.5.1.1.23	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian Transfer Syntax	1.2.840.10008.1.2.2		

2.2.5.3.1.2 SOP specific Conformance for SOP classes – Meta SOP Classes

The Biograph mCT DICOM Print Management SCU conforms to the DICOM Basic Grayscale Print Management Meta SOP Class and Basic Color Print Management Meta SOP Class.

The application uses a setting platform to define the properties of the connected DICOM SCP, e.g.:

- maximum number of print jobs in the queue
- maximum number of print copies
- supported film sizes of the connected DICOM SCP
- supported film formats of the DICOM SCP
- lookup table definition.

The printing is only suspended in the case of a failure return status of the SCP.

2.2.5.3.1.2.1 Basic Film Session SOP Class

The Basic Film Session information object definition describes all the user defined parameter which are common for all the films of a film session. The Basic Film Session refers to one or more Basic Film Boxes and that are printed on one hardcopy printer.

The Biograph mCT DICOM Print application supports the following DIMSE Service Elements for the Basic Film Session SOP class as SCU:

- N-CREATE
- N-DELETE

The Basic Film Session SOP class N-CREATE-RQ (SCU) uses following attributes:

Table 32: Used Basic Film Session N-CREATE_RQ attributes

Attribute name	Tag	Usage SCU	Supported Values
Number of Copies	(2000,0010)	U	1

Medium Type	(2000,0030)	U	BLUE FILM CLEAR FILM PAPER
Film Destination	(2000,0040)	U	MAGAZINE PROCESSOR

The number of copies sent to the DICOM printer is always 1, the job is sent n times for n copies.

The Affected SOP Instance UID received with N-CREATE-RSP message from SCP will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Session SOP Class - see table below:

Table 33: Attributes of the N-DELETE-RQ on the Basic Film Session SOP Class

Attribute name	Tag	Source of information
Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Session

The N-DELETE-RQ on the Basic Film Session SOP Class is used to delete the complete Basic Film Session SOP Instance hierarchy.

The Basic Film Session SOP class interprets the following status codes (from N-CREATE-RSP, N-DELETE-RSP messages):

Table 34: Basic Film Session SOP status

Service Status	Meaning	Protocol Codes
Failure	Film session SOP instances hierarchy does not contain film box SOP instances	C600
	Unable to create print job, print queue is full	C601
	Image size is larger than images box size	C603
Warning	Memory allocation not supported	B600
	Film session printing is not supported	B601
	Film box does not contain image box (empty page)	B602
Success	Film belonging to the film session are accepted for printing	0000

2.2.5.3.1.2.2 Basic Film Box SOP Class

The Basic Film Box information object definition describes all the user defined parameter of one film of the film session. The Basic Film Box information description defines the presentation parameters which are common for all images on a given sheet of film.

The Basic Film Box refers to one or more Image Boxes.

Supported as SCU are:

- N-CREATE
- N-ACTION
- N-DELETE

The Basic Film Box SOP class N-CREATE-RQ message uses following attributes (the used values for each attribute depend on the DICOM Printer configuration within the Biograph mCT DICOM print management SCU):

Table 35: Used Film Box N-CREATE_RQ attributes

Attribute name	Tag	Usage SCU	Supported Values
Image Display Format	(2010,0010)	M	STANDARD\C-R
Referenced Film Session Sequence	(2010,0500)	M	
>Referenced SOP Class UID	(0008,1150)	M	1.2.840.10008.5.1.1.1
>Referenced SOP Instance UID	(0008,1155)	M	
Film Orientation	(2010,0040)	M	PORTRAIT LANDSCAPE
Film Size ID	(2010,0050)	M	8INX10IN 10INX12IN 10INX14IN 11INX14IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM
Magnification Type	(2010,0060)	M	BILINEAR CUBIC NONE REPLICATE
Border Density	(2010,0100)	U	BLACK WHITE
Max Density	(2010,0130)	U	0 < Value
Min Density	(2010,0120)	U	0 < Value < 50
Illumination	(2010,015E)	U	0 < Value Required if Presentation LUT is present
Reflective Ambient Light	(2010,0160)	U	0 < Value Required if Presentation LUT is present
Referenced Presentation LUT Sequence	(2050,0500)	U	

For Page Mode printing the Image Display format used is Standard\1,1. For Image Mode Printing the Image Display format used is Standard\C,R where C is the number of Columns and R is the number of Rows as specified in the Hardcopy Layout.

The N-CREATE-RSP message from the Print SCP includes the Referenced Image Box Sequence with its SOP Class / Instance UID pairs which will be kept internally to be further used for the subsequent Basic Image Box SOP Class N-SET-RQ messages.

When all Image Boxes (including parameters) for the film sheet have been set, the Biograph mCT DICOM print manager will issue a N-ACTION-RQ message with the SOP Instance UID of the Basic Film Box (returned in N-CREATE-RSP of Basic Film Box SOP class) and the Action Type ID of 1.

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Box SOP Class - see table below:

Table 36: Attributes of the N_DELETE_RQ on the Basic Film Session SOP Class

Attribute name	Tag	Source of information
Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Box

The Basic Film Box SOP class interprets the following status codes:

Table 37: Basic Film Box SOP status

Service Status	Meaning	Protocol Codes
Failure	Unable to create print job; print queue is full	C602
	Image size is larger than image box size	C603
Warning	Film box does not contain image box (empty page)	B603
	Requested MinDensity or MaxDensity outside of printer's operating range	B605
Success	Film accepted for printing	0000

2.2.5.3.1.2.3 Basic Grayscale Image Box SOP Class

The Basic Grayscale Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data which apply to a single image of a sheet of film.

The Grayscale Image Box SOP class uses only the N-SET-RQ with the following attributes

Table 38: Used Basic Grayscale Image Box N-SET attributes

Attribute name	Tag	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
Basic Grayscale Image Sequence	(2020,0110)	M	

>Samples Per Pixel	(0028,0002)	M	1
>Photometric Interpretation	(0028,0004)	M	MONOCH-ROME2
>Rows	(0028,0010)	M	
>Columns	(0028,0011)	M	
>Pixel Aspect Ratio	(0028,0034)	M	
>Bits Allocated	(0028,0100)	M	8,16
>Bits Stored	(0028,0101)	M	8,12
>High Bit	(0028,0102)	M	7,11
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0,0010)	M	

The Grayscale Image Box SOP class interprets following status codes:

Table 39: Basic Grayscale Image Box SOP status

Service Status	Meaning	Protocol Codes
Failure	Image contains more pixel than printer can print in Image box	C603
	Insufficient memory in printer to store the image	C605
Warning	Requested MinDensity or MaxDensity outside of printer's operating range	B605
Success		0000

2.2.5.3.1.2.4 Basic Color Image Box SOP Class

The Basic Color Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data which apply to a single image of a sheet of film.

The Color Image Box SOP class uses only the N-SET-RQ with the following attributes

Table 40: Used Basic Color Image Box N-SET attributes

Attribute name	Tag	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
Basic Color Image Sequence	(2020,0111)	M	
>Samples Per Pixel	(0028,0002)	M	3
>Photometric Interpretation	(0028,0004)	M	RGB

>Planar Configuration	(0028,0006)	M	0
>Rows	(0028,0010)	M	
>Columns	(0028,0011)	M	
>Pixel Aspect Ratio	(0028,0034)	M	
>Bits Allocated	(0028,0100)	M	8
>Bits Stored	(0028,0101)	M	8
>High Bit	(0028,0102)	M	7
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0,0010)	M	

The Color Image Box SOP class interprets following status codes:

Table 41: Basic Color Image Box SOP status

Service Status	Meaning	Protocol Codes
Failure	Image contains more pixel than printer can print in Image box	C603
	Insufficient memory in printer to store the image	C605
Warning	Image size larger than image box size.	B604
Success		0000

2.2.5.3.1.2.5 Presentation LUT SOP Class

The objective of the Presentation LUT is to realize image hardcopy printing tailored for specific modalities, applications, and user preferences.

The output of the Presentation LUT is Presentation Values (P-Values). P-Values are approximately related to human perceptual response. They are intended to facilitate common input for hardcopy. P-Values are intended to be independent of the specific class or characteristics of the hardcopy device.

Table 42: Attributes of the N_CREATE_RQ on the Presentation LUT SOP Class

Attribute name	Tag	Usage SCU	Supported Values
Presentation LUT Shape	(2050,0020)	U	IDENTITY

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and is used for later requests on the Basic Film Box (N-CREATE-RQ) and on the Presentation LUT (N-DELETE-RQ) - see below.

Table 43: Attributes of the N_DELETE_RQ on the Presentation LUT SOP Class

Attribute name	Tag	Source of information

Requested SOP Instance UID	(0000,1000) -> (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Presentation LUT

The Presentation LUT SOP class interprets the following status codes:

Table 44: Attributes of the N_DELETE_RQ on the Presentation LUT SOP Class

Service Status	Meaning	Protocol Codes
Warning	Requested Min Density or Max Density outside the HCD's operating range. HCD will use its respective minimum or maximum density value instead.	B605
Success	Presentation LUT successfully created	0000

2.2.5.3.1.2.6 Printer SOP Class

The Printer SOP Class is the possibility to monitor the status of the hardcopy printer in a synchronous and an asynchronous way.

The SCU uses the mandatory N-EVENT Report DIMSE service to monitor the changes of the printer status in an asynchronous way

It can directly ask the Printer (SCP) for its status or can receive Events from the Print SCP asynchronously:

- N_GET as SCU
- N_EVENT_REPORT as SCU

In both cases the following information is supported:

Table 45: Used Printer N-EVENT report

Event type name	Event	Attributes	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

Table 46: Mandatory Printer N-GET-RSP, N-EVENT-REPORT-RQ attributes

Attribute name	Tag	Usage SCP	supported values
Printer Status	(2110,0010)	M	NORMAL FAILURE WARNING
Printer Status Info	(2110,0020)	M	See Section 2.2.5.3.1.2.8

For a detailed description of how Biograph mCT reacts to the various messages please refer to the section: "DICOM Print SCU - detailed status displays".

2.2.5.3.1.2.7 Print Job SOP Class

The Print Job SOP Class is the possibility to monitor the execution of the print process.

The Biograph mCT DICOM Print application supports the optional N-EVENT-REPORT DIMSE service to receive the changes of the print job status in an asynchronous way.

It can receive events from the Print SCP asynchronously:

- N-EVENT-REPORT

Note
Biograph mCT does not support receiving N-EVENT from the camera during print sessions, normally this is configurable in the camera.

The following information is supported:

Table 47: Used Print Job N-EVENT report

Event type name	Event	Attributes	Tag	Usage SCU
Pending	1	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Printing	2	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Done	3	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Failure	4	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U

For a detailed description of how Biograph mCT reacts to the various messages please refer to the section: "DICOM Print SCU - detailed status displays".

2.2.5.3.1.2.8 DICOM Print SCU - detailed status displays

The following tables document the behavior of the Biograph mCT DICOM Print AE in response to messages received for the printer SOP class and the print job SOP class.

Definitions of camera symbols:

- Idle: Camera is installed and ready; idle icon is displayed.
- Interact: The user has to react in near future, but not immediately.
  Example: A camera was low in 8x10 clear sheets: LOW 8x10 CLR was sent by N-EVENT-REPORT.
- Queue Stopped: The user has to react immediately. Either the camera needs immediate interaction or a job has been aborted.
  Example: A camera is out of 8x10 clear sheets, or camera is down, or a film job is aborted.

Note
Different camera symbols are displayed according to the Printer Status Info.

Table 48: Printer Status Infos within Printer SOP Class/Execution Status Infos within Print Job SOP Class

Printer Status info/Execution Status info	**Description**	**Message string visible in the Status Bar**	**Other action for *UI*/camera symbol**
NORMAL	Camera is ready.	Camera is ready.	<None>/idle
BAD RECEIVE MGZ	There is a problem with the film receive magazine. Films from the printer cannot be transported into the magazine.	Problem with receive magazine.	<None>/interact
BAD SUPPLY MGZ	There is a problem with a film supply magazine. Films from this magazine cannot be transported into the printer.	Problem with supply magazine.	<None>/interact
CALIBRATING	Printer is performing self calibration, it is expected to be available for normal operation shortly.	Self calibration. Please wait.	<None>/idle
CALIBRATION ERR	An error in the printer calibration has been detected, quality of processed films may not be optimal.	Problem in calibration. Film quality may not be optimal.	<None>/interact
CHECK CHEMISTRY	A problem with the processor chemicals has been detected, quality of processed films may not be optimal.	Problem with chemistry. Film quality may not be optimal.	<None>/interact
CHECK SORTER	There is an error in the film sorter	Error in film sorter.	<None>/interact
CHEMICALS EMPTY	There are no processing chemicals in the processor, films will not be printed and processed until the processor is back to normal.	Camera chemistry empty. Please check.	<None>/interact

CHEMICALS LOW	The chemical level in the processor is low, if not corrected, it will probably shut down soon.	Camera chemistry low. Please check.	<None>/interact
COVER OPEN	One or more printer or processor covers, drawers, doors are open.	Camera cover, drawer or door open.	<None>/interact
ELEC CONFIG ERR	Printer configured improperly for this job.	Camera configured improperly for this job. Queue stopped.	Queue for this camera will be STOPPED/Queue stopped
ELEC DOWN	Printer is not operating due to some unspecified electrical hardware problem.	Camera electrical hardware problem.	<None>/interact
ELEC SW ERROR	Printer not operating for some unspecified software error.	Camera software problem. Queue stopped.	Queue for this camera will be STOPPED/queue stopped
EMPTY 8x10	The 8x10 inch film supply magazine is empty.	8x10 film supply empty.	<None>/interact
EMPTY 8x10 BLUE	The 8x10 inch blue film supply magazine is empty.	8x10 blue film supply empty.	<None>/interact
EMPTY 8x10 CLR	The 8x10 inch clear film supply magazine is empty.	8x10 clear film supply empty.	<None>/interact
EMPTY 8x10 PAPR	The 8x10 inch paper supply magazine is empty.	8x10 paper supply empty.	<None>/interact
EMPTY 10x12	The 10x12 inch film supply magazine is empty.	10x12 film supply empty.	<None>/interact
EMPTY 10x12 BLUE	The 10x12 inch blue film supply magazine is empty.	10x12 blue film supply empty.	<None>/interact
EMPTY 10x12 CLR	The 10x12 inch clear film supply magazine is empty.	10x12 clear film supply empty.	<None>/interact
EMPTY 10x12 PAPR	The 10x12 inch paper supply magazine is empty.	10x12 paper supply empty.	<None>/interact
EMPTY 10x14	The 10x14 inch film supply magazine is empty.	10x14 film supply empty.	<None>/interact
EMPTY 10x14 BLUE	The 10x14 inch blue film supply magazine is empty.	10x14 blue film supply empty.	<None>/interact
EMPTY 10x14 CLR	The 10x14 inch clear film supply magazine is empty.	10x14 clear film supply empty.	<None>/interact
EMPTY 10x14 PAPR	The 10x14 inch paper supply magazine is empty.	10x14 paper supply empty.	<None>/interact
EMPTY 11x14	The 11x14 inch film supply magazine is empty.	11x14 film supply empty.	<None>/interact
EMPTY 11x14 BLUE	The 11x14 inch blue film supply magazine is empty.	11x14 blue film supply empty.	<None>/interact

EMPTY 11x14 CLR	The 11x14 inch clear film supply magazine is empty.	11x14 clear film supply empty.	<None>/interact
EMPTY 11x14 PAPR	The 11x14 inch paper supply magazine is empty.	11x14 paper supply empty.	<None>/interact
EMPTY 14x14	The 14x14 inch film supply magazine is empty.	14x14 film supply empty.	<None>/interact
EMPTY 14x14 BLUE	The 14x14 inch blue film supply magazine is empty.	14x14 blue film supply empty.	<None>/interact
EMPTY 14x14 CLR	The 14x14 inch clear film supply magazine is empty.	14x14 clear film supply empty.	<None>/interact
EMPTY 14x14 PAPR	The 14x14 inch paper supply magazine is empty.	14x14 paper supply empty.	<None>/interact
EMPTY 14x17	The 14x17 inch film supply magazine is empty.	14x17 film supply empty.	<None>/interact
EMPTY 14x17 BLUE	The 14x17 inch blue film supply magazine is empty.	14x17 blue film supply empty.	<None>/interact
EMPTY 14x17 CLR	The 14x17 inch clear film supply magazine is empty.	14x17 clear film supply empty.	<None>/interact
EMPTY 14x17 PAPR	The 14x17 inch paper supply magazine is empty.	14x17 paper supply empty.	<None>/interact
EMPTY 24x24	The 24x24 inch film supply magazine is empty.	24x24 film supply empty.	<None>/interact
EMPTY 24x24 BLUE	The 24x24 inch blue film supply magazine is empty.	24x24 blue film supply empty.	<None>/interact
EMPTY 24x24 CLR	The 24x24 inch clear film supply magazine is empty.	24x24 clear film supply empty.	<None>/interact
EMPTY 24x24 PAPR	The 24x24 inch paper supply magazine is empty.	24x24 paper supply empty.	<None>/interact
EMPTY 24x30	The 24x30 inch film supply magazine is empty.	24x30 film supply empty.	<None>/interact
EMPTY 24x30 BLUE	The 24x30 inch blue film supply magazine is empty.	24x30 blue film supply empty.	<None>/interact
EMPTY 24x30 CLR	The 24x30 inch clear film supply magazine is empty.	24x30 clear film supply empty.	<None>/interact
EMPTY 24x30 PAPR	The 24x30 inch paper supply magazine is empty.	24x30 paper supply empty.	<None>/interact
EMPTY A4 PAPR	The A4 paper supply magazine is empty.	A4 paper supply empty.	<None>/interact
EMPTY A4 TRANS	The A4 transparency supply magazine is empty.	A4 transparency supply empty.	<None>/interact
EXPOSURE FAILURE	The exposure device has failed due to some unspecified reason.	Exposure device has failed.	<None>/interact

FILM JAM	A film transport error has occurred and a film is jammed in the printer or processor.	Film jam.	<None>/interact
FILM TRANSP ERR	There is a malfunction with the film transport, there may or may not be a film jam.	Film transport problem.	<None>/interact
FINISHER EMPTY	The finisher is empty.	Finisher is empty.	<None>/interact
FINISHER ERROR	The finisher is not operating due to some unspecified reason.	Finisher problem.	<None>/interact
FINISHER LOW	The finisher is low on supplies	Finisher low.	<None>/interact
LOW 8x10	The 8x10 inch film supply magazine is low.	8x10 film supply low.	<None>/interact
LOW 8x10 BLUE	The 8x10 inch blue film supply magazine is low.	8x10 blue film supply low.	<None>/interact
LOW 8x10 CLR	The 8x10 inch clear film supply magazine is low.	8x10 clear film supply low.	<None>/interact
LOW 8x10 PAPR	The 8x10 inch paper supply magazine is low.	8x10 paper supply low.	<None>/interact
LOW 10x12	The 10x12 inch film supply magazine is low.	10x12 film supply low.	<None>/interact
LOW 10x12 BLUE	The 10x12 inch blue film supply magazine is low.	10x12 blue film supply low.	<None>/interact
LOW 10x12 CLR	The 10x12 inch clear film supply magazine is low.	10x12 clear film supply low.	<None>/interact
LOW 10x12 PAPR	The 10x12 inch paper supply magazine is low.	10x12 paper supply low.	<None>/interact
LOW 10x14	The 10x14 inch film supply magazine is low.	10x14 film supply low.	<None>/interact
LOW 10x14 BLUE	The 10x14 inch blue film supply magazine is low.	10x14 blue film supply low.	<None>/interact
LOW 10x14 CLR	The 10x14 inch clear film supply magazine is low.	10x14 clear film supply low.	<None>/interact
LOW 10x14 PAPR	The 10x14 inch paper supply magazine is low.	10x14 paper supply low.	<None>/interact
LOW 11x14	The 11x14 inch film supply magazine is low.	11x14 film supply low.	<None>/interact
LOW 11x14 BLUE	The 11x14 inch blue film supply magazine is low.	11x14 blue film supply low.	<None>/interact

LOW 11x14 CLR	The 11x14 inch clear film supply magazine is low.	11x14 clear film supply low.	<None>/interact
LOW 11x14 PAPR	The 11x14 inch paper supply magazine is low.	11x14 paper supply low.	<None>/interact
LOW 14x14	The 14x14 inch film supply magazine is low.	14x14 film supply low.	<None>/interact
LOW 14x14 BLUE	The 14x14 inch blue film supply magazine is low.	14x14 blue film supply low.	<None>/interact
LOW 14x14 CLR	The 14x14 inch clear film supply magazine is low.	14x14 clear film supply low.	<None>/interact
LOW 14x14 PAPR	The 14x14 inch paper supply magazine is low.	14x14 paper supply low.	<None>/interact
LOW 14x17	The 14x17 inch film supply magazine is low.	14x17 film supply low.	<None>/interact
LOW 14x17 BLUE	The 14x17 inch blue film supply magazine is low.	14x17 blue film supply low.	<None>/interact
LOW 14x17 CLR	The 14x17 inch clear film supply magazine is low.	14x17 clear film supply low.	<None>/interact
LOW 14x17 PAPR	The 14x17 inch paper supply magazine is low.	14x17 paper supply low.	<None>/interact
LOW 24x24	The 24x24 inch film supply magazine is low.	24x24 film supply low.	<None>/interact
LOW 24x24 BLUE	The 24x24 inch blue film supply magazine is low.	24x24 blue film supply low.	<None>/interact
LOW 24x24 CLR	The 24x24 inch clear film supply magazine is low.	24x24 clear film supply low.	<None>/interact
LOW 24x24 PAPR	The 24x24 inch paper supply magazine is low.	24x24 paper supply low.	<None>/interact
LOW 24x30	The 24x30 inch film supply magazine is low.	24x30 film supply low.	<None>/interact
LOW 24x30 BLUE	The 24x30 inch blue film supply magazine is low.	24x30 blue film supply low.	<None>/interact
LOW 24x30 CLR	The 24x30 inch clear film supply magazine is low.	24x30 clear film supply low.	<None>/interact
LOW 24x30 PAPR	The 24x30 inch paper supply magazine is low.	24x30 paper supply low.	<None>/interact
LOW A4 PAPR	The A4 paper supply magazine is low.	A4 paper supply low.	<None>/interact
LOW A4 TRANS	The A4 transparency supply magazine is low.	A4 transparency supply low.	<None>/interact
NO RECEIVE MGZ	The film receive magazine no available.	Film receiver not available.	<None>/interact

NO RIBBON	The ribbon cartridge needs to be replaced.	Replace ribbon cartridge.	<None>/interact
NO SUPPLY MGZ	The film supply magazine specified for this job is not available.	Film supply not available.	<None>/interact
CHECK PRINTER	The printer is not ready at this time, operator intervention is required to make the printer available.	Check camera.	<None>/interact
CHECK PROC	The processor is not ready at this time, operator intervention is required to make the printer available.	Check processor.	<None>/interact
PRINTER DOWN	The printer is not operating due to some unspecified reason.	Camera down.	<None>/interact
PRINTER INIT	The printer is not ready at this time, it is expected to become available without intervention, For example, it may be in a normal warm-up state.	Camera initializing.	**<None>/idle**
PRINTER OFFLINE	The printer has been disabled by an operator or service person.	Camera off-line.	<None>/interact
PROC DOWN	The processor is not operating due to some unspecified reason.	Processor down.	<None>/interact
PROC INIT	The processor is not ready at this time, it is expected to become available without intervention. For example, it may be in a normal warm-up state.	Processor initializing.	**<None>/idle**
PROC OVERFLOW FL	Processor chemicals are approaching the overflow full mark.	Processor chemicals overflow.	<None>/interact
PROC OVERFLOW HI	Processor chemicals have reached the overflow full mark.	Processor chemicals near overflow.	<None>/interact
QUEUED	Print job in Queue	-	**<None>/idle**
RECEIVER FULL	The Film receive magazine is full.	Receiver full.	<None>/interact
REQ MED NOT INST	The requested film, paper, or other media supply magazine is installed in the printer, but may be available with operator intervention.	Install media supply.	<None>/interact

REQ MED NOT AVAI	The requested film, paper, or other media requested is not available on this printer.	Media supply not available on this camera. Queue stopped. Change camera.	**Queue for this camera will be STOPPED/queue stopped**
RIBBON ERROR	There is an unspecified problem with the print ribbon.	Error with print ribbon.	<None>/interact
SUPPLY EMPTY	The printer is out of film.	Camera out of film.	<None>/interact
SUPPLY LOW	The film supply is low.	Film supply low.	<None>/interact
UNKNOWN	There is an unspecified problem.	Unspecified problem with camera.	<None>/interact

Table 49: Printer Status Infos: Additional Agfa printer status infos

Printer Status info	**Description**	**Message string visible in the Status Bar**	**Other action for *syngo*/camera symbol**
WARMING UP	Printer is in the warm-up stage. Spooling of print jobs to disk is still possible.	Camera is warming up.	**<None>idle**
OFFLINE	Printer is switched off-line. Spooling of print jobs to disk is still possible.	Camera is switched off-line.	<None>/interact
NONE	General printer warning, no specific information is available. Spooling of print jobs to disk is still possible.	-	<None>/idle

Table 50: Printer Status Infos: Additional Kodak infos for PACS Link (formerly Imation cameras)

Printer Status info	**Description**	**Message string visible in the Status Bar**	**Other action for *syngo*/camera symbol**
SUPPLY MGZ ERR	The supply magazine has an error.	Film supply has an error.	<None>/interact

Table 51: Printer Status Infos: Additional Kodak infos for Kodak 190

Printer Status info	**Description**	**Message string visible in the Status Bar**	**Other action for *syngo*/camera symbol**
PRINTER STOPPED	The printer has stopped	Camera has stopped.	<None>/interact
FATAL ERROR	Fatal error.	Fatal error. Queue stopped.	**Queue for this camera will be STOPPED/queue stopped**

Table 52: Printer Status Infos: Additional Kodak infos for 2180/1120

Printer Status info	Description	Message string visible in the Status Bar	Other action for *syngo*/camera symbol
PRINTER NOT RDY	Printer not ready.	Camera not ready.	<None>/interact
CHECK PROCESSOR	Check processor.	Check processor.	<None>/interact
NO TONER	No toner.	No toner.	<None>/interact
FATAL	Fatal error.	Fatal error. Queue stopped.	**Queue for this camera will be STOPPED/queue stopped**

Table 53: Printer Status Infos: Additional Codonics infos

Printer Status info	Description	Message string visible in the Status Bar	Other action for *syngo*/camera symbol
STANDARD	Printer is ready.	Camera is ready.	**<None>/Normal**
LOAD A-SIZE	Load A-size media.	Load A-size media.	<None>/interact
LOAD A-DVPAPER	Load A-size black and white paper.	Load A-size black and white paper.	<None>/interact
LOAD A-CVPAPER	Load A-size color paper.	Load A-size color paper.	<None>/interact
LOAD A-CVTRANS	Load A-size transparencies.	Load A-size transparencies.	<None>/interact
LOAD A4-SIZE	Load A4-size media.	Load A4-size media.	<None>/interact
LOAD A4-DVPAPER	Load A4-size black and white paper.	Load A4-size black and white paper.	<None>/interact
LOAD A4-CVPAPER	Load A4-size color paper.	Load A4-size color paper.	<None>/interact
LOAD A4-CVTRANS	Load A4-size transparencies.	Load A4-size transparencies.	<None>/interact
LOAD LA-SIZE	Load LA-size media.	Load LA-size media.	<None>/interact
LOAD LA-DVPAPER	Load LA-size black and white paper.	Load LA-size black and white paper.	<None>/interact
LOAD LA-CVPAPER	Load LA-size color paper.	Load LA-size color paper.	<None>/interact
LOAD LA-CVTRANS	Load LA-size transparencies.	Load LA-size transparencies.	<None>/interact
LOAD LA4-SIZE	Load LA4-size media.	Load LA4-size media.	<None>/interact

LOAD LA4-DVPAPER	Load LA4-size black and white paper.	Load LA4-size black and white paper.	<None>/interact
LOAD LA4-CVPAPER	Load LA4-size color paper.	Load LA4-size color paper.	<None>/interact
LOAD LA4-CVTRANS	Load LA4-size transparencies.	Load LA4-size transparencies.	<None>/interact
LOAD XLA-SIZE	Load XLA-size media.	Load XLA-size media.	<None>/interact
LOAD XLA-DVPAPER	Load XLA-size black and white paper.	Load XLA-size black and white paper.	<None>/interact
LOAD XLA-CVPAPER	Load XLA-size color paper.	Load XLA-size color paper.	<None>/interact
LOAD XLA-CVTRANS	Load XLA-size transparencies.	Load XLA-size transparencies.	<None>/interact
LOAD XLA4-SIZE	Load XLA4-size media.	Load XLA4-size media.	<None>/interact
LOAD XLA4-DVPAPE	Load XLA4-size black and white paper.	Load XLA4-size black and white paper.	<None>/interact
LOAD XLA4-CVPAPE	Load XLA4-size color paper.	Load XLA4-size color paper.	<None>/interact
LOAD XLA4-CVTRAN	Load XLA4-size transparencies.	Load XLA4-size transparencies.	<None>/interact
LOAD XLW-SIZE	Load XLW-size media.	Load XLW-size media.	<None>/interact
LOAD XLW-DVPAPER	Load XLW-size black and white paper.	Load XLW-size black and white paper.	<None>/interact
LOAD XLW-CVPAPER	Load XLW-size color paper.	Load XLW-size color paper.	<None>/interact
LOAD 8X10-SIZE	Load 8x10 media.	Load 8x10 media.	<None>/interact
LOAD 8X10-DVFILM	Load 8x10 black and white film.	Load 8x10 black and white film.	<None>/interact
SUPPLY MISSING	The film supply magazine specified for this job is not available.	Film supply not available.	<None>/interact
RIBBON MISSING	Ribbon is missing.	Ribbon is missing.	<None>/interact
RIBBON EMPTY	Ribbon is empty.	Ribbon is empty.	<None>/interact
TOP COVER OPEN	Top cover of printer is open.	Top cover of camera is open.	<None>/interact

Additional DICOM Execution Status Information - evaluation

Execution Status info	Description	Message string visible in the Status Bar	Other action for *syngo*/camera symbol
INVALID PAGE DES	The specified page layout cannot be printed or other page description errors have been detected.	Film Job cannot be printed on this camera. Queue stopped. Please redirect film job.	**Queue for this camera will be STOPPED/queue stopped**
INSUFFIC MEMORY	There is not enough memory available to complete this job.	Not enough memory available in camera. Queue stopped. Please continue queue or change camera.	**Queue for this camera will be STOPPED/queue stopped**
NONE	General printer warning, no specific information is available. Spooling of print jobs to disk is still possible.	-	<None>/idle

Additional DICOM Execution Status Information

Printer Status Info and Execution Status Info are defined terms and can therefore be extended or reduced by camera manufacturers. Therefore syngo shall be flexible.

If any other printer status info or execution status info is received, syngo will react as shown in the following table:

Printer Status /Execution	Printer/Execution Status Info	Description	Message string visible in the Status Bar	Other action for *syngo*/camera symbol
WARNING	<any other>	<not defined status info>	Camera info: <status info>	**<None>/interact**
FAILURE	<any other>	<not defined status info>	Camera info: <status info> Queue stopped.	**Queue for this camera will be STOPPED/Queue stopped**

2.2.5.4 Association Acceptance Policy

N/A

2.2.6 Modality Worklist AE Specification

The Modality Worklist SCU (patient registration in conjunction with the network application) requests that the remote SCP performs a match of all keys specified in the query against the information in its worklist database.

2.2.6.1 SOP Classes

The Biograph mCT DICOM application provides Standard Conformance to the DICOM V3.0 SOP Classes listed in "Table 1: Network Services" section "Worklist Management" of the Conformance Statement Overview

2.2.6.2 Association Policy

2.2.6.2.1 General

It is possible to configure a cyclic update of the modality scheduler database through a background worklist request with date/time and modality information.

In addition the user can request worklist update with "Update Worklist". No duplicate entries will be added in the Scheduler DB. Entries are uniquely identified by the Study Instance UID (0020,000D) for the Requested Procedure and the SPS ID (0040,0009) in the SPS Sequence (0040,0100).

An interactive worklist query can be issued with search criteria entered in the patient based Query dialog from the patient browser.

The default PDU size used will be 28 KB.

2.2.6.2.2 Number of Associations

The Biograph mCT DICOM application initiates one association at a time to query worklist entry data.

2.2.6.2.3 Asynchronous Nature

The Biograph mCT DICOM implementation does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.6.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3: Implementation Identifying Information” in the “Conformance Statement Overview”.

2.2.6.3 Association Initiation Policy

The network application will (if configured) query the worklist periodically or by user request. Ever then it establishes an association by using the DICOM association services. During association establishment the negotiation of SOP classes to exchange the capabilities of the SCU and the SCP is not supported.

The following DIMSE-C operation is supported as SCU:

- C-FIND

2.2.6.3.1 Activity – Query (Update) Worklist

A network application will perform worklist queries with the C-FIND request at regular intervals. In addition it can be triggered by immediate request. The received worklist items will be compared with the contents of the local scheduler database. New items will be inserted into scheduler database.

After each broad query all RP/SPS that were cancelled or rescheduled to another modality at the RIS will be automatically removed from the scheduler DB if

1. the Examination of this procedure has not been started or finished yet
2. the corresponding configuration item "Automatic removal of cancelled/rescheduled Request" was checked in the Service UI under DICOM / HIS/RIS Node

No automatic clean-up of the scheduler DB is performed after a Patient based Query since the worklist received does not give the complete list of all currently scheduled procedures for the modality.

2.2.6.3.1.1 Proposed Presentation Contexts

The Biograph mCT DICOM application will propose Presentation Contexts as shown in the following table:

Table 54: Proposed presentation context for Modality Worklist

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model- FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.1		

2.2.6.3.1.2 SOP specific Conformance for SOP classes

Search Key Attributes of the Worklist C-FIND

The Biograph mCT DICOM worklist SCU supports "broad worklist queries" with all required search keys.

The following tables describe the "broad query" search keys that the SCU supports, which is a query for all tasks scheduled for the own modality or own modality application entity defined with the following search keys[9]:

Table 55: Search Key Attributes in a broad worklist query

Attribute name[10]	Tag	Matching Key Type	query value
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Scheduled Station AE Title	(0040,0001)	R	Configurable[11]: own AET or "*"
>Scheduled Procedure Step Start Date	(0040,0002)	R	Configurable: inserted in UI[12] or "n days before to m days after today"
>Scheduled Procedure Step Start Time	(0040,0003)	R	Configurable: inserted in UI[13] or 0:00-23:59

[9] The worklist query will also contain additional(empty) optional DICOM defined attributes as valid for C-FIND-RQ. As a special extension in this version the query will send (0010,1002) Other Patient IDs Sequence.

[10] No other attributes of Register Dialog used for C-FIND

[11] One and only one of the attributes "Modality" and "AE Title" is set to "*". There is a configuration parameter telling which of them. The other one is always set to the "own" value (i.e. own modality respectively own AE Title). Use Options/Configuration/PatientRegistration, "HIS/RIS" tabcard for configuration.

[12] <startDate>-<endDate>

[13] <startTime>-<endTime>

>Modality	(0008,0060)	R	Configurable[b]: own modality or "*"

Note
Since various SCP implementations depend on the Specific Character Set attribute to be sent with the C-FIND in order to deliver the attribute filled with the C-FIND-RSP (see below), as a default the attribute will be sent even if empty. In case this turns out to be a problem for a specific SCP in cooperation with Siemens this can be configured not to include this attribute.

Return Key Attributes of the Worklist C-FIND-RSP

The Biograph mCT DICOM worklist SCU supports worklist queries with return key attributes of all types. The following tables describe the return keys that the SCU supports.

An "x" in the UI column will indicate that the attribute is visualized when browsing the Worklist results with Patient Browser and/or during Patient Registration. The Patient Browser display is additionally influenced by the related Browser configuration.

A tag in the IOD column will indicate that the related attribute is included into the SOP Instances of the IODs created during processing of this worklist request.

A tag in the MPPS column will indicate that the related attribute is included into the SOP Instances of the MPPS objects created during processing of this worklist request. (See also Table 60 and Table 62).

Table 56: Basic Worklist C_FIND_RSP Return Key Attributes

Attribute name	Tag	Return Key Type	UI	IOD	MPPS	Notes
SOP Common						
Specific Character Set[14]	(0008,0005)	1C	-	(0008, 0005)	(0008, 0005)	
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	1				
>Modality	(0008,0060)	1	x	(0008, 0060)	(0008, 0060)	
>Requested Contrast Agent	(0032,1070)	2C	x	(0032, 1070)		
>Scheduled Station AE Title	(0040,0001)	1	x		(0040, 0241) *	*"Scheduled Station AE Title" is taken as default for "Performed Station AE Title"
>Scheduled Procedure Step Start Date	(0040,0002)	1	x			
>Scheduled Procedure Step Start Time	(0040,0003)	1	x			
>Scheduled Procedure Step End Date	(0040,0004)	3	-			

[14] The Specific Character Set distributed via Modality Worklist by the hospital network shall reflect the global hospital context, e.g. a hospital with German context shall not restrict the worklist entries to ISO_IR 6 but supply a character set adequate to hold all German language text input.

>Scheduled Procedure Step End Time	(0040,0005)	3	-			
>Scheduled Performing Physician's Name	(0040,0006)	1	x	(0008, 1050)	(0008, 1050) *	*"Scheduled Performing Physician's Name" is taken as default for "Performing Physician's Name"
>Scheduled Procedure Step Description	(0040,0007)	1C	x	(0040, 0007) (0040, 0254)	(0040, 0007) (0040, 0254)	*"Scheduled Procedure Step Description" is taken as default for "Performed Procedure Step Description"
>Scheduled Protocol Code Sequence**	(0040,0008)	1C	-	(0040, 0008) (0040, 0260) *	(0040, 0008) (0040, 0260) *	** Uses universal sequence match *"Scheduled Protocol Code Sequence" is taken as default for "Performed Protocol Code Sequence"
>>Code Value	(0008,0100)	1C	x			
>>Coding Scheme Designator	(0008,0102)	1C	x			
>>Coding Scheme Version	(0008,0103)	3	x			
>>Code Meaning	(0008,0104)	3	x			
>Scheduled Procedure Step ID	(0040,0009)	1	x	(0040, 0009) (0040, 0253)	(0040, 0009) (0040, 0253)	*"Scheduled Procedure Step ID" is taken as default for "Performed Procedure Step ID"
>Scheduled Station Name	(0040,0010)	2	x			
>Scheduled Procedure Step Location	(0040,0011)	2	x		(0040, 0242) *	*"Scheduled Procedure Step Location" is taken as default for "Performed Procedure Step Location"
>Pre-Medication	(0040,0012)	2C	x			
>Scheduled Procedure Step Status	(0040,0020)	3	x			
>Comments on the Scheduled Procedure Step	(0040,0400)	3	-			
Requested Procedure						
Referenced Study Sequence**	(0008,1110)	2	-	(0008, 1110)	(0008, 1110)	** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			
Study Instance UID	(0020,000D)	1	-	(0020, 000D)	(0020, 000D)	
Requested Procedure Description	(0032,1060)	1C	x	(0032, 1060)	(0032, 1060)	

Requested Procedure Code Sequence**	(0032,1064)	1C	-	(0032, 1032) * (0032, 1064)	(0032, 1032) *	** Uses universal sequence match *"Requested Procedure Code Sequence" is taken as default for "Procedure Code Sequence"
>Code Value	(0008,0100)	1C	x			
>Code Scheme Designator	(0008,0102)	1C	x			
>Code Scheme Version	(0008,0103)	3	x			
>Code Meaning	(0008,0104)	3	x			
Requested Procedure ID	(0040,1001)	1	x	(0040, 1001) (0020, 0010) *	(0040, 1001) (0020, 0010) *	*"Requested Procedure ID" is taken as default for "Study ID"
Reason for the Requested Procedure	(0040,1002)	3	-			
Requested Procedure Priority	(0040,1003)	2	x			
Patient Transport Arrangements	(0040,1004)	2	-			
Requested Procedure Location	(0040,1005)	3	-			
Confidentiality Code	(0040,1008)	3	-			
Reporting Priority	(0040,1009)	3	-			
Names of Intended Recipients of results	(0040,1010)	3	-	(0008, 1048)		
Requested Procedure Comments	(0040,1400)	3	x			
Imaging Service Request						
Accession Number	(0008,0050)	2	x	(0008, 0050)	(0008, 0050)	
Referring Physician's Name	(0008,0090)	2	x	(0008, 0090)		
Requesting Physician	(0032,1032)	2	x	(0032, 1032)	(0032, 1032)	
Requesting Service	(0032,1033)	3	x	(0032, 1033)		
Reason for the Imaging Service Request	(0040,2001)	3	-			
Issuing Date of Imaging Service Request	(0040,2004)	3	-			
Issuing Time of Imaging Service Request	(0040,2005)	3	-			
Placer Order Number / Imaging Service Request*	(0040,2016)	3	-		(0040, 2016)	*Old tag (0040,2006) is retired and not used
Filler Order Number / Imaging Service Request*	(0040,2017)	3	-		(0040, 2017)	*Old tag (0040,2007) is retired and not used

Order entered by...	(0040,2008)	3	-			
Order Enterer's Location	(0040,2009)	3	-			
Order Callback Phone Number	(0040,2010)	3	-			
Imaging Service Request Comments	(0040,2400)	3	x			
Visit Identification						
Institution Name	(0008,0080)	3	x	(0008, 0080)		
Institution Address	(0008,0081)	3	-	(0008, 0081)		
Institution Code Sequence**	(0008,0082)	3	-			** Uses universal sequence match
>Code Value	(0008,0100)	1C				
>Code Scheme Designator	(0008,0102)	1C				
>Code Scheme Version	(0008,0103)	3				
>Code Meaning	(0008,0104)	3				
Admission ID	(0038,0010)	2	x			
Issuer of Admission ID	(0038,0011)	3	-			
Visit Status						
Visit Status ID	(0038,0008)	3	-			
Current Patient Location	(0038,0300)	2	x			
Patient's Institution Residence	(0038,0400)	3	-			
Visit Comments	(0038,4000)	3	-			
Visit Relationship						
Referenced Study Sequence**	(0008,1110)	3	-			** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			
Referenced Patient Sequence**	(0008,1120)	2	-		(0008, 1120)	** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			
Visit Admission						
Referring Physician's Name	(0008,0090)	2	x	(0008, 0090)		
Referring Physician's Address	(0008,0092)	3	-			
Referring Physician's Phone Numbers	(0008,0094)	3	-			
Admitting Diagnoses Description**	(0008,1080)	3	x	(0008, 1080)		** Uses universal sequence match

Admitting Diagnosis Code Sequence	(0008,1084)	3				
>Code Value	(0008,0100)	1C				
>Code Scheme Designator	(0008,0102)	1C				
>Code Scheme Version	(0008,0103)	3				
>Code Meaning	(0008,0104)	3				
Route of Admissions	(0038,0016)	3	-			
Admitting Date	(0038,0020)	3	-			
Admitting Time	(0038,0021)	3	-			
Patient Identification						
Patient's Name	(0010,0010)	1	x	(0010, 0010)	(0010, 0010)	
Patient ID	(0010,0020)	1	x	(0010, 0020)	(0010, 0020)	
Issuer of Patient ID	(0010,0021)	3	-	(0010, 0021)		
Other Patient IDs	(0010,1000)	3	x	(0010, 1000)		
Other Patient Names	(0010,1001)	3	x	(0010, 1001)		
Other Patient IDs Sequence	(0010,1002)	3	x	(0010, 1002)		
Patient's Birth Name	(0010,1005)	3	-	(0010, 1005)		
Patient's Mother's Birth Name	(0010,1060)	3	-	(0010, 1060)		
Medical Record Locator	(0010,1090)	3	-	(0010, 1090)		
Patient Demographic						
Patients Birth Date	(0010,0030)	2	x	(0010, 0030)	(0010, 0030)	
Patients Birth Time	(0010,0032)	3	-	(0010, 0032)		
Patient's Sex	(0010,0040)	2	x	(0010, 0040)	(0010, 0040)	
Patient's Insurance Plan Code Sequence**	(0010,1050)	3	-	(0010, 1050)		** Uses universal sequence match
>Code Value	(0008,0100)	1C				
>Code Scheme Designator	(0008,0102)	1C				
>Code Scheme Version	(0008,0103)	3				
>Code Meaning	(0008,0104)	3				
Patient's Age	(0010,1010)	3	x	(0010, 1010)		
Patient's Size	(0010,1020)	3	x	(0010, 1020)		

Patient's Weight	(0010,1030)	2	x	(0010, 1030)		
Patient's Address	(0010,1040)	3	x	(0010, 1040)		
Military Rank	(0010,1080)	3	x	(0010, 1080)		
Branch of Service	(0010,1081)	3	-	(0010, 1081)		
Country of Residence	(0010,2150)	3	-	(0010, 2150)		
Region of Residence	(0010,2152)	3	-	(0010, 2152)		
Patient's Telephone Numbers	(0010,2154)	3	-	(0010, 2154)		
Ethnic Group	(0010,2160)	3	x	(0010, 2160)		
Occupation	(0010,2180)	3	-	(0010, 2180)		
Patient's Religious Preference	(0010,21F0)	3	-	(0010, 21F0)		
Patient Comments	(0010,4000)	3	x	(0010, 4000)		
Patient Data Confidentiality Constraint Description	(0040,3001)	2	x	(0040, 3001)		
Patient Medical						
Medical Alerts	(0010,2000)	2	x	(0010, 2000)		
Contrast Allergies	(0010,2110)	2	x	(0010, 2110)		
Pregnancy Status	(0010,21C0)	2	x	(0010, 21C0)		
Smoking Status	(0010,21A0)	3	x	(0010, 21A0)		
Last Menstrual Date	(0010,21D0)	3	x	(0010, 21D0)		
Additional Patient History	(0010,21B0)	3	x	(0010, 21B0)		
Special Needs	(0038,0050)	2	x	(0038, 0050)		
Patient State	(0038,0500)	2	x	(0038, 0500)		
Patient Relationship						
Referenced Study Sequence**	(0008,1110)	3	-			** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			

Referenced Visit Sequence**	(0008,1125)	3	-			** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			
Referenced Patient Alias Sequence**	(0038,0004)	3	-			** Uses universal sequence match
>Referenced SOP Class UID	(0008,1150)	1C	-			
>Referenced SOP Instance UID	(0008,1155)	1C	-			

2.2.6.3.2 Activity – Get Worklist

With "Get Worklist" in the patient based Worklist Query dialog the entered attributes are used to form a worklist request identifier. With the response data the Patient Registration dialog can be updated to perform examination in advance. The response data are additionally placed in the scheduler database.

2.2.6.3.2.1 Proposed Presentation Context

The same Presentation contexts as with "Update Worklist" will be proposed (Table 54).

2.2.6.3.2.2 SOP Specific Conformance for SOP Classes

Search Key Attributes of the Worklist C-FIND

The Biograph mCT DICOM worklist SCU supports "narrow worklist queries" with all required search keys.
The following table describes the search keys that the SCU supports for a patient-based worklist query, which is defined by the following search keys:

Table 57: Search Key Attributes in a patient-based worklist query

Attribute name	Tag	Matching Key Type	query value
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Scheduled Performing Physician's Name	(0040,0006)	R	inserted in UI or zero length
Requested Procedure			
Requested Procedure ID	(0040,1001)	O	inserted in UI or zero length
Imaging Service Request			
Accession Number	(0008,0050)	O	inserted in UI or zero length
Referring Physician's Name	(0008,0090)	O	inserted in UI or zero length
Visit Status			

Current Patient Location	(0038,0300)	O	inserted in UI or zero length
Patient Identification			
Patient's Name[15]	(0010,0010)	R	inserted in UI or zero length
Patient ID	(0010,0020)	R	inserted in UI or zero length

Return Key Attributes used from the Worklist C-FIND-RSP

Please see Table 56.

Status Codes of the Worklist C-FIND

The worklist SCU interprets following status codes:

Table 58: C-FIND Response Status

Service Status	Meaning	Status Codes (0000,0900)	Related Fields
Failed	Out of Resources	A700	(0000,0902)
	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

[15] Please be aware that although in the UI there are different entries for First Name and Last Name of a patient these are combined into one query attribute. Querying just for the Last Name (without wildcard) or not providing a first letter for the First Name may prevent expected matches.

2.2.6.4 Association Acceptance Policy

N/A

2.2.7 Modality Performed Procedure Step AE Specification SOP Classes SOP Classes

The Modality Performed Procedure Step SCU (Patient Registration and MPPS UI) provide information about a performed real-world Procedure to a remote SCP (Information System).

2.2.7.1 SOP Classes

The Biograph mCT DICOM application provides Standard Conformance to the DICOM V3.0 SOP Classes listed in “Table 1: Network Services” section "Worklist Management" of the Conformance Statement Overview

2.2.7.2 Association Policy

2.2.7.2.1 General

The creation of a MPPS Instance is done automatically by the Biograph mCT DICOM application whenever a patient is registered for image acquisition through the Patient Registration dialog. Exception: In case of Emergency Patients the MPPS is created only when the user explicitly sends a corresponding message from the MPPS user interface.

Further updates on the MPPS data can be done interactively from the related MPPS user interface. The MPPS "Complete" or "Discontinued" states can only be set from user interface.

The default PDU size used will be 28 KB.

2.2.7.2.2 Number of Associations

The Siemens DICOM application initiates one association at a time, to create or set MPPS instance.

2.2.7.2.3 Asynchronous Nature

The Siemens DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

2.2.7.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3: Implementation Identifying Information” in the “Conformance Statement Overview”.

2.2.7.3 Association Initiation Policy

The Biograph mCT DICOM Application Entity acts as a Service Class User (SCU) for the Modality Performed Procedure Step Service Class (to notify a RIS about status of a procedure while it is performed).

To do so, it will issue a:

- N-CREATE DIMSE according to the CREATE Modality Performed Procedure Step SOP Instance operation or a
- N-SET DIMSE to update the contents and state of the MPPS according to the SET Modality Performed Procedure Step Information operation

2.2.7.3.1 Activity – Patient Registered

The associated Real-World activity is to send examination information to an SCP by using the DICOM Modality Performed Procedure Step Service.

2.2.7.3.1.1 Proposed Presentation Contexts

The Siemens DICOM application will propose Presentation Contexts as shown in the following table:

Table 59: Proposed presentation contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.1		

2.2.7.3.1.2 SOP specific Conformance for SOP classes

Attributes used for the Performed Procedure Step N-CREATE

The DICOM Modality Performed Procedure Step SCU informs the remote SCP when the examination of a scheduled procedure step will be performed (i.e. the patient is registered). The N-CREATE message is sent when the examination is started with successful registration of patient data. The following table describes the supported attributes for a N-CREATE message.

Table 60: Performed Procedure Step N-CREATE Attributes

Attribute name	Tag	Required Type	Value
SOP Common			
Specific Character Set	(0008,0005)	1C	from MWL or created
Performed Procedure Step Relationship			
Scheduled Step Attribute Sequence	(0040,0270)	1	
>Study Instance UID	(0020,000D)	1	from MWL or created
>Referenced Study Sequence	(0008,1110)	2	from MWL or zero length
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Accession Number	(0008,0050)	2	from MWL or user input
>Placer Order Number / Imaging Service Request	(0040,2016)	3	from MWL or zero length
>Filler Order Number / Imaging Service Request	(0040,2017)	3	from MWL or zero length

>Requested Procedure ID	(0040,0001)	2	from MWL or user input
>Requested Procedure Description	(0032,1060)	2	from MWL or zero length
>Scheduled Procedure Step ID	(0040,0009)	2	from MWL or zero length
>Scheduled Procedure Step Description	(0040,0007)	2	from MWL or zero length
>Scheduled Protocol Code Sequence	(0040,0008)	2	from MWL or zero length
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Scheme Version	(0008,0103)	3	
>>Code Meaning	(0008,0104)	3	
Patient's Name	(0010,0010)	2	from MWL or user input
Patient ID	(0010,0020)	2	from MWL or user input or created
Patients Birth Date	(0010,0030)	2	from MWL or user input
Patient's Sex	(0010,0040)	2	from MWL or user input
Referenced Patient Sequence	(0008,1120)	2	from MWL or zero length
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Performed Procedure Step Information			
Performed Procedure Step ID	(0040,0253)	1	from SPS ID or created
Performed Station AE Title	(0040,0241)	1	own AE Title
Performed Station Name	(0040,0242)	2	own hostname
Performed Location	(0040,0243)	2	from SPS Location or zero length
Performed Procedure Step Start Date	(0040,0244)	1	created
Performed Procedure Step Start Time	(0040,0245)	1	created

Performed Procedure Step Status	(0040,0252)	1	IN PROGRESS
Performed Procedure Step Description	(0040,0254)	2	from SPS Description or zero length
Performed Procedure Type Description	(0040,0255)	2	zero length
Procedure Code Sequence	(0008,1032)	2	from Requested Procedure Code or zero length
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Procedure Step End Date	(0040,0250)	2	zero length
Performed Procedure Step End Time	(0040,0251)	2	zero length
Exposure dose Sequence **	(0040,030E)	3	
>RadiationMode	(0018,115A)	3	
>KVp	(0018,0060)	3	
>XrayTubeCurrentInuA	(0018,8151)	3	
>Exposure Time	(0018,1150)	3	
>FilterType	(0018,1160)	3	
>FilterMaterial	(0018,7050)	3	
>CommentsOnRadiationDose	(0040,0310)	3	
>OrganDose ***	(0040,0316)	3	
Image Acquisition Results			
Modality	(0008,0060)	1	CT
Study ID	(0020,0010)	2	from Requested Procedure ID or created

Performed Protocol Code Sequence	(0040,0260)	2	from Scheduled Protocol Code SQ or zero length
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	2	
>Performing Physician's Name	(0008,1050)	2C	from MWL or user input
>Protocol Name	(0008,1030)	1C	default value
>Operator's Name	(0008,1070)	2C	user input
>Series Instance UID	(0020,000E)	1C	created
>Series Description	(0008,103E)	2C	zero length
>Retrieve AE Title	(0008,0054)	2C	zero length
>Referenced Image Sequence	(0008,1140)	2C	zero length
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C	zero length
All other attributes from Radiation Dose Module		3	<modify and add attributes as setup for this Biograph mCT application>
All other attributes from Billing and Material Code Module		3	<modify and add attributes as setup for this Biograph mCT application>

** - This sequence added is not part of this module as per DICOM standard. Support for this sequence in this module is additional and is not confirming to DICOM standard.

*** - As per the DICOM standard this attribute is not a part of the Exposure Dose Sequence.

Status Codes of the Performed Procedure Step N-CREATE

The Performed Procedure Step SCU interprets the following status values:

Table 61: N-SET Response Status

Service Status	Meaning	Status Codes (0000,0900)
Failure	Processing Failure	0110
	No such attribute	0105
	Invalid attribute value	0106
	Duplicate SOP Instance	0111

	No such SOP Instance	0112
	No such SOP class	0118
	Class instance conflict	0119
	Missing attribute	0120
	Missing attribute value	0121
	Resource limitation	0213
Success	Successful Operation	0000

2.2.7.3.2 Activity – Update

The associated Real-World activity is to send examination information to an SCP by using the DICOM Modality Performed Procedure Step Service either implicitly (examination) or explicitly (MPPS UI).

2.2.7.3.2.1 Proposed Presentation Contexts

The same Presentation Contexts as Table 59 will be proposed.

2.2.7.3.2.2 SOP specific Conformance for SOP classes

Attributes used for the Performed Procedure Step N-SET

The Biograph mCT DICOM performed procedure step SCU informs the remote SCP about the performed examination and its status. The N-Set message is sent once for each reconstruction of acquisition data with status "IN_PROGRESS". The N-SET message is sent on user input with status "COMPLETED" or "DISCONTINUED", respectively. This is intended to be used when the examination is finished with status "COMPLETED" or when the examination could not be completed with status "DISCONTINUED" (already sent automatically when examination is ended via End Exam and no acquisition was done). The following table describes the supported attributes for a N-SET message.

Table 62: Performed Procedure Step N-SET Attributes

Attribute name	Tag	Required Type	Value
Performed Procedure Step Information			
Performed Procedure Step Status	(0040,0252)	3	IN_PROGRESS or COMPLETED or DISCONTINUED (see above)
Performed Procedure Step Description	(0040,0254)	3	from SPS Description or user input
Performed Procedure Type Description	(0040,0255)	3	zero length

Procedure Code Sequence	(0008,1032)	3	from Requested Procedure Code or empty on user change (see IHE Technical Framework Y3, App. C Note 6)
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Scheme Version	(0008,0103)	1C	
>Code Meaning	(0008,0104)	1C	
Performed Procedure Step End Date	(0040,0250)	3	created or zero length
Performed Procedure Step End Time	(0040,0251)	3	created or zero length
Exposure dose Sequence **	(0040,030E)	3	
>RadiationMode	(0018,115A)	3	
>KVp	(0018,0060)	3	
>XrayTubeCurrentInuA	(0018,8151)	3	
>Exposure Time	(0018,1150)	3	
>FilterType	(0018,1160)	3	
>FilterMaterial	(0018,7050)	3	
>Comments On Radiation Dose	(0040,0310)	3	
>Organ Dose ***	(0040,0316)	3	
Image Acquisition Results			
Performed Protocol Code Sequence	(0040,0260)	3	from Scheduled Protocol Code SQ or user input
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Scheme Version	(0008,0103)	1C	
>Code Meaning	(0008,0104)	1C	
Performed Series Sequence	(0040,0340)	1	
>Performing Physician's Name	(0008,1050)	2C	from MWL or user input [empty if Study Split is used]

>Protocol Name	(0018,1030)	1C	name of Scan Protocol (Siemens standard or user defined) [dummy if Study Split is used]
>Operator's Name	(0008,1070)	2C	user input [empty if Study Split is used]
>Series Instance UID	(0020,000E)	1C	created [dummy if Study Split is used]
>Series Description	(0008,103E)	2C	range name with generated reconstruction information or user input [empty if Study Split is used]
>Retrieve AE Title	(0008,0054)	2C	from Storage Commitment RSP or zero length
>Referenced Image Sequence	(0008,1140)	2C	created [empty if Study Split is used]
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C	zero length
Radiation Dose			
Total Number of Exposures	(0040,0301)	3	created (number of scans)
Distance Source to Detector (SID)	(0018,1110)	3	created
Distance Source to Entrance	(0040,0306)	3	created
Comments on Radiation Dose	(0040,0310)	3	created (one line per scan)[16]
Billing and Material Management Code			
Film Consumption Sequence	(0040,0321)	3	created or zero length
>Number of Films	(2100,0170)	3	
>Medium Type	(2000,0030)	3	
>Film Size ID	(2010,0050)	3	

[16] The following format is used:
RangeName: kV=xxx mAs=xxx CTDIvol=xxx DLP=xxx
CTDIvol and DLP is not provided for Topogram scans.

Billing Supplies and Devices Sequence	(0040,0324)	3	user input in Examination Card (example values below) or MPPS window
>Billing Item Sequence	(0040,0296)	3	
>>Code Value	(0008,0100)	1C	e.g. contrast media code
>>Code Scheme Designator	(0008,0102)	1C	e.g. contrast media catalog
>>Code Meaning	(0008,0104)	1C	e.g. contrast media name
>Quantity Sequence	(0040,0293)	1C	
>>Quantity	(0040,0294)	3	e.g. volume of contrast media
>>Measuring Units Sequence	(0040,0295)	3	
>>>Code Value	(0008,0100)	1C	e.g. cm3
>>>Code Scheme Designator	(0008,0102)	1C	e.g. UCUM
>>>Code Scheme Version	(0008,0103)	1C	e.g. 1.4
>>>Code Meaning	(0008,0104)	1C	e.g. cm3

** - This sequence added is not part of this module as per DICOM standard. Support for this sequence in this module is additional and is not confirming to DICOM standard.

*** - As per the DICOM standard this attribute is not a part of the Exposure Dose Sequence.

Status Codes of the Performed Procedure Step N-SET

The Performed Procedure Step SCU interprets the following status values:

Table 63: N-SET Response Status

Service Status	Meaning	Status Codes (0000,0900)
Failure	Processing Failure: Performed Procedure Step Object may no longer be updated	0110
	No such attribute	0105
	Invalid attribute value	0106
	No such SOP Instance	0112
	Invalid object instance	0117
	No such SOP class	0118

	Class instance conflict	0119
	Missing attribute value	0121
	Resource limitation	0213
Success	MPPS instance set	0000

2.2.7.4 Association Acceptance Policy

N/A

2.3 Communication Profiles

2.3.1 Supported Communication Stacks

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

The product target operating system is Windows 10.

2.3.1.1 OSI Stack

Not supported.

2.3.1.2 TCP/IP Stack

The Biograph mCT DICOM application uses the TCP/IP stack from the Windows 10 system. It uses the MergeCOM-3 subroutine library from Merge Technologies Inc. that is based on a Berkeley socket interface.

2.3.1.2.1 API

The Biograph mCT DICOM application uses the MergeCOM library that is based on a TCP/IP socket interface.

2.3.1.2.2 Physical Media Support

The Biograph mCT DICOM application is indifferent to the physical medium over which TCP/IP executes. It inherits it from the target operating system upon which it executes.

2.3.1.3 Point-to-Point Stack

Not supported.

2.4 Network Interfaces

2.4.1 Physical Network Interface

2.4.2 Additional Protocols

2.4.3 IPv4 and IPv6 Support

2.5 Configuration

2.5.1 AE Title / Presentation Address Mapping

To ensure unique identification the hostname should be part of the AE Titles (see examples below, hostname = station4). The string can be up to 16 characters long and must not contain any extended characters, only 7 bit ASCII characters (excluding control characters) are allowed according to DICOM standard. An example name is HRI_station4. Another common setting is the use of the hostname in capital letters, e.g. "STATION4".

Note:

The current implementation does not support the full DICOM standard syntax. Spaces and special characters (like &<>") in the AE title string are not supported.

2.5.1.1 DICOM Verification

The Verification Service uses the AE configuration of the DICOM Service that is checked with the C-ECHO message. E.g. Verification will use the Storage AE, if initiated to check the configuration of a remote DICOM node.

2.5.1.2 DICOM Storage/Storage Commitment/QR AE Title

There is a common AE Title for Storage, Storage Commitment and Query/Retrieve. It can be configured via Service UI in Configuration/DICOM/General.

The port is set to the fixed value of 104.

2.5.1.3 DICOM Modality Worklist and MPPS AE Title

There is a common AE Title for Modality Worklist and MPPS. It can be configured via Service UI in Configuration/DICOM/General.

2.5.1.4 DICOM Print AE Title

There is a separate AE Title for Print application. It can be configured via Service UI in Configuration/DICOM/General.

No input of AETs starting with a numeric character is possible.

2.5.1.5 Remote AE Titles and Presentation Addresses

Remote AETs, host names, IP addresses and port numbers can be configured using the Service application. For each AET a list of supported services can be configured.

2.5.2 Configurable Parameters

2.5.2.1 Storage, Storage Commitment and Query/Retrieve

The Service Configuration Tool can be used to set the AETs, port numbers, host names, IP addresses and capabilities for the remote nodes' (SCP's). The user can select transfer syntaxes, compression types and query models for each SCP separately.

If the C-STORE is initiated by a user, only the transfer syntax will be proposed that is configured via Options -> Transfer -> Network Nodes (No Compression, Lossless JPEG, Lossy JPEG). The default transfer syntax (ILE) will be proposed in any case.

If the C-STORE is initiated by an autotransfer rule or by the C-MOVE SCP all transfer syntaxes that are configured in the Service UI for this particular network destination will be proposed. (Compressed Transfer Syntaxes will be proposed first followed by the uncompressed Transfer Syntaxes).

Additional configurable parameters for Storage Commitment are:
When acting as SCU:

- flag to indicate whether the association will be kept open to receive the response or to close the association and be prepared to receive the response on another association.
- time-out which defines how long the association of N-ACTION is kept to receive a N-EVENT-REPORT on the same association. The same value is used to wait for a N-EVENT-REPORT on another association (applicability of transaction UID).
  (default 1 h)

When acting as SCP:

- flag to indicate whether an archive system is installed.

2.5.2.2 Print

The Service application can be used to configure the SCP (DICOM Printer).

These parameters are mandatory to be set:

- AET
- Host name
- IP address
- Port number

These parameters have defaults as per configuration file and can be changed:

- Default camera
- Pixel size
- Additional or changed film sheet formats (e.g. inch 14x14, inch 14x17, ...)
- List with mapping pixel size to each film sheet format
- Minimal density
- Stored printed film jobs
- Media type
- Film destination

2.5.2.3 Modality Worklist

The Service application can be used to set the AETs, port numbers, host names, IP addresses, capabilities, and time-outs for the remote nodes (SCPs).

Additional configurable parameters for Basic Worklist Query are:

- Query Waiting time - the time to wait for the C-FIND-RSP after sending the C-FIND-RQ (default 20 s)
- Max. Query Match Number - the maximum number of entries accepted in one worklist (default is 200)
- Query Interval - the time between two C-FIND-RQs to the Hospital Information System (default is 60 min.)
- - Broad Worklist Query behavior: two values are defined:
    Set the AE Title search attribute to the own AE Title, and the Modality search attribute to "*".
    Set the Modality search attribute to the own modality and the AE Title search attribute to "*".

The sending of an empty Specific Character Set in a C-FIND-RQ can be omitted by configuration. However, this is not available in the Service application but must be set by a Siemens service technician.

2.5.2.4 Modality Performed Procedure Step

The Service application can be used to configure the Modality Worklist SCP to be a Modality Performed Procedure Step SCP also.

Additional configurable parameters for Modality Performed Procedure Step are:

- Default Catalog Name - (0008,0102) used for items entered in MPPS UI
- Default Catalog Version - (0008,0103) used for items entered in MPPS UI

2.5.3 Default Parameters

This configuration tool also uses some default parameters:

- maximal PDU size set to 262144 Bytes
- - time-out for accepting/rejecting an association request: 60 s
- - time-out for responding to an association open/close request: 60 s
- - time-out for accepting a message over network: 60 s
- - time-out for waiting for data between TCP/IP-packets: 60 s

The Time-outs for waiting for a Request/Response message from the remote node are as follows:

- for Storage SCP/SCU: 600 s
- for Storage Commitment SCU:
  time-out for Response to N-ACTION: 600 s
  time-out for N-EVENT-REPORT: configurable, see Section 2.5.2.
- for Query/Retrieve SCP/SCU: 600 s
- for Modality Worklist SCU: configurable, see section 6.2 on page 194.
- for Print Management SCU:
  time-out for Response to N-SET-RQ: 240 s
  time-out for Response to other Requests: 60 s

3 Media Interchange

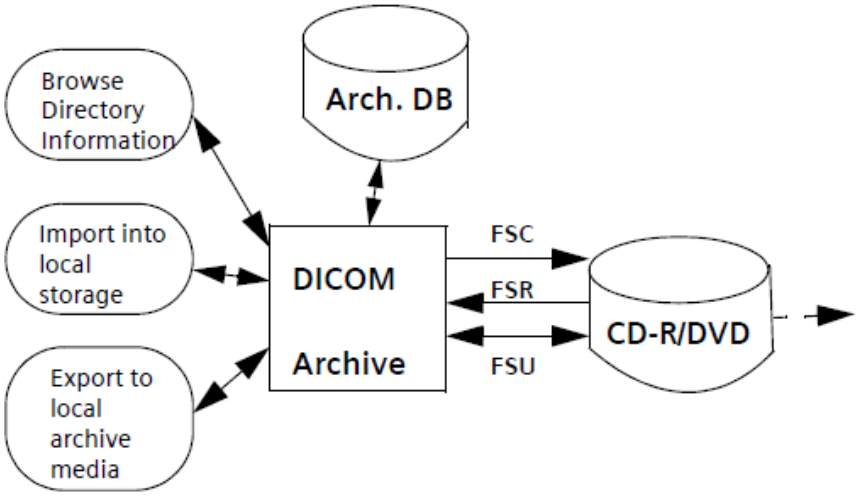
This part contains the Conformance Statement to all "Offline Media Application Profiles (incl. private extensions)" supported by the Biograph mCT archive options.

The application profiles supported shall be:

- Standard Application Profiles
- Augmented Application Profiles
- syngo private Application Profiles

3.1 Implementation Model

3.1.1 Application Data Flow Diagram



The DICOM archive application will serve as an interface to the CD-R/DVD off-line medium device. It serves interfaces to include the off-line media directory into the browser and to copy SOP instances to a medium or retrieve SOP Instances from medium into local storage.

The FSU role will update new SOP Instances only to media with pre-existing File Sets conforming to the Application Profiles supported.

The contents of the DICOMDIR will be temporarily stored in Archive-Database.

3.1.2 Functional Definition of AEs

The Biograph mCT DICOM off-line media storage application consists of the DICOM Archive application entity serving all interfaces to access off-line media. The DICOM Archive application is capable of

- creating a new File-set onto an unwritten medium (Export to...)
- updating an existing File-set by writing new SOP Instances onto the medium (Export to...)
- importing SOP Instances from the medium onto local storage
- reading the File-set's DICOMDIR information temporarily into database and pass it to display application

3.1.3 Sequencing of Real-World Activities

The DICOM Archive application will not perform updates before the Directory information of the DICOMDIR is completely read.

When performing updates, the SOP instances are checked for existence before updating. Duplicate instances will be avoided.

3.1.4 File Meta Information for Implementation Class and Version

The Biograph mCT DICOM Archive Application provides the Implementation Class UID of 1.3.12.2.1107.5.1.4 and the Implementation Version Name of "SIEMENS_S5VC50A".

3.2 AE Specifications

3.2.1 DICOM Archive – Specification

The DICOM Archive provides Standard conformance to Media Storage Service Class (Interchange Option).

Table 64: Application profiles, Activities, and Roles for DICOM Archive

Application Profiles Supported	Real-World Activity	Role	SC Option
PRI-SYNGO-CD PRI-SYNGO-DVD AUG-GEN-CD AUG-CTMR-CD17 STD-XA1K-CDa	Browse Directory Information	FSR	Interchange
	Import into local Storage	FSR	Interchange
	Export to local archive media	FSC,FSU	Interchange
STD-GEN-CD STD-CTMR-CD STD-XABC-CD STD-XA1K-CD TD-US-zz-yF-xxxxxx18	Browse Directory Information	FSR	Interchange
	Import into local Storage	FSR	Interchange

On syngo-based products the Private Extended syngo Profile (e.g. PRI-SYNGO-CD) will be preferably used by the system. The General-Purpose Interchange Profile (STD-GEN-CD), Ultrasound Profile (STD-US-xxx), CT and MR Image Profile (STD-CTMR-xxx), Waveform Interchange (STD-WVFM-xxx), Basic Cardiac Profile (STD-XABC-CD) and 1024 X-Ray Angiographic Profile (STD-XA1K-CD) will be supported with read capability of the related media.

3.2.1.1 File Meta Information for the Application Entity

The Source Application Entity Title is set by configuration. See section 6 on page 193 for details.

3.2.1.2 Real-World Activities

3.2.1.2.1 Real World Activity: Browse Directory Information

The DICOM Archive application acts as FSR using the interchange option when requested to read the media directory.

The DICOM archive application will read the DICOMDIR and insert that directory entries, that are valid for the application profiles supported, into a local database. The database can then be used for browsing media contents.

[17] With no private SOP Class used, the PRI-SYNGO-CD profile definitions are appropriate to describe the augmentation of the related -STD Profiles.
[18] All combinations of the following values for zz, yF and xxxxxx are suported:
'yF' can take two values: SF for Single Frame and MF for Multi Frame.
'zz' can take three values: ID (Image Display), SC(Spatial Calibration) and CC (Combined Calibration)
xxxxxx can take 2 values: CDR and DVD

Note:
Icon Image SQ is also supported in DICOMDIR. But only those Icon Images with Bits Allocated (0028,0100) equal to 8 and size 64 by 64 or 128 by 128 pixels are imported into database and are visible in Patient Browser.

3.2.1.2.1.1 Application Profiles for Real World activity: Browse Directory Information

See Table 64: for the Application Profiles listed that invoke this Application Entity for the Browse Directory Information RWA.

3.2.1.2.2 Real World Activity: Import into local Storage

The DICOM Archive application acts as FSR using the interchange option when requested to read SOP Instances from the medium into the local storage.

The SOP Instance selected from the media directory will be copied into the local storage. Only SOP Instances, that are valid for the application profile supported and are listed as supported by the Storage SCP Conformance section (see 3.2), can be retrieved from media storage. This is due to the fact that the Browse Directory Information will filter all SOP Instances not matching the Application profiles supported.

During operation no "Attribute Value Precedence" is applied to the SOP Instances. Detached Patient Management is not supported (please refer to DICOM part 11, Media Storage Application Profiles).

For media conforming to the STD-GEN-CD Profile the SOP classes listed in Table 1 in the Conformance Statement Overview are supported as FSR using Explicit VR Little Endian (1.2.840.10008.1.2.1).

3.2.1.2.2.1 Application Profiles for Real World activity: Import into Local Storage

See Table 64 the Application Profiles listed that invoke this Application Entity for the Copy to Local Storage RWA.

3.2.1.2.3 Real World Activity: Export to local Archive Media

The DICOM Archive application acts as FSU (for media with existing DICOM file-set) or FSC (media not initialized) using the interchange option when requested to copy SOP Instances from the local storage to local Archive medium.

The DICOM Archive application will receive a list of SOP Instances to be copied to the local archive medium. According to the state of the medium inserted (new medium, Medium with DICOM file-set) the validity of the SOP Instances according to the applicable profile is checked. Only valid SOP Instances are accepted.

When the DICOM archive application is requested to copy SOP Instances the preferred application profile according configuration will be used to validate and copy the referred SOP Instances. When creating a new file set no Descriptor File will be allocated and the related ID is not used.

The DICOM archive application will not close the medium.

3.2.1.2.3.1 Application Profiles for Real World activity: Export to local Archive Media

For the Application Profiles listed those invoke this Application Entity for the Export to local Archive Media RWA.

3.2.1.3 SOP Classes and Transfer Syntaxes

For media conforming to the STD-GEN-CD Profile the SOP classes listed in Table 1 in the Conformance Statement Overview are supported as FSR using Explicit VR Little Endian (1.2.840.10008.1.2.1).

3.3 Augmented and Private Application Profiles

3.3.1 Augmented Application Profiles

3.3.1.1 AUG-GEN-CD

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-SYNGO-CD Profile are applicable to denote the augmentations for the STD-GEN-CD Standard Profile.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see next section).

The Siemens non-image is typically used for raw data and 3D private data.

3.3.1.2 AUG-CTMR-xxxx

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-SYNGO-CD Profile are applicable to denote the augmentations for the STD-CTMR-CD Standard Profiles.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see next section).

3.3.1.3 AUG-XA1K-CD

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-SYNGO-CD Profile are applicable to denote the augmentations for the STD-XA1K-CD Standard Profile.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see next section)

3.4 Syngo private offline Media Application Profiles

This section will contain a syngo specific Application Profile. The Structure of this Application Profile is defined in Part 11 of the 2000 DICOM Standard.

It is needed to describe the requirements for Offline Media Storage of the private IOD (Non-Image IOD).

3.4.1 Class and Profile Identification

This document defines an Application Profile class for "*syngo* speaking[19]" modalities or applications.

The identifier for this class shall be PRI-SYNGO. This class is intended to be used for interchange of extended and private Information Objects via CD-R offline media between dedicated acquisition or workstation modalities built from a common *syngo* architecture.

The specific application profiles in this class are shown in the table below:

Table 65: syngo private Application Profile

Application Profile	Identifier	Description
"*syngo* speaking" System on CD-R	PRI-SYNGO-CD	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD)
"*syngo* speaking" System on DVD-R	PRI-SYNGO-DVD	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD)

[19] 'syngo' and 'We speak syngo' are registered trademarks of Siemens Healthineers

Equipment claiming conformance for this syngo Application Profile Class shall make a clear statement on handling of the private defined SOP Instances.

3.4.2 Clinical Context

This application profile facilitates the interchange of original acquired and derived images and private data related to them. Typical media interchange would be from in-lab acquisition equipment to dedicated workstations and archive systems with specific extensions to handle the private data objects (in both directions). Additionally, images used to prepare procedures, multi-modality images (e.g. integrated US) and images derived from primary diagnostic images, such as annotations, quantitative analysis images, reference images, screen capture images may be interchanged via this profile.

3.4.2.1 Roles and Service Class Options

This Application Profile uses the Media Storage Service Class defined in PS 3.4 with the Interchange Option. The Application Entity shall support one or more of the roles of File Set Creator (FSC), File Set Reader (FSR), and File Set Updater (FSU), defined in PS3.10.

3.4.2.1.1 File Set Creator

The Application Entity acting as File Set Creator generates a File Set under the PRI-SYNGO Application Profiles.

File Set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes and Private SOP Classes stored in the File Set.

In case of the PRI-SYNGO-CD and PRI-SYNGO-DVD profile, the FSC shall offer the ability to allow multi-session (additional information may be subsequently added to the disc). For both profiles a multi-session media can be finalized.

Note:
A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one CD-R, the FSC will create multiple independent DICOM File Sets such that each File Set can reside on a single CD-R medium controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to reflect that there is more than one disc for this set of files (e.g. a study).

3.4.2.1.2 File Set Reader

The role of the File Set Reader shall be used by Application Entities which receive the transferred File Set. File Set Readers shall be able to read all the defined SOP Instances files defined for the specific Application Profiles to which a conformance claim is made, using all the defined Transfer Syntaxes.

3.4.2.1.3 File Set Updater

The role of the File Set Updater shall be used by Application Entities, which receive a transferred File Set and update it by the addition of processed information.

File Set Updaters shall be able to read and update the DICOMDIR file. File Set Updaters do not have to read the image/private information objects. File Set Updaters shall be able to generate any of the SOP Instance files defined for the specific Application Profiles to which a conformance claim is made, and to read and update the DICOMDIR file.

In case of the PRI-SYNGO-CD and PRI-SYNGO-DVD profile, the FSU shall offer the ability to allow multi-session (additional information can be subsequently added to the disc).

Note (for CD-R and DVD-R)

If the disc has not been finalized, the File Set Updater will be able to update information assuming there is enough space on the disc to write a new DICOMDIR file, the information, and the fundamental CD-R/DVD-R control structures. CD-R/DVD-R control structures are the structures that inherent to CD-R/DVD-R standards; see PS 3.12

3.4.3 PRI-SYNGO Profiles

3.4.3.1 SOP Classes and Transfer Syntaxes

These Application Profiles are based on the Media Storage Service Class with the Interchange Option. In the table below Transfer Syntax UID "RLE Lossless" applies only for decompression.

Table 66: SOP Classes and Transfer Syntax

Information Object Definitions	SOP Class UID	Transfer Syntax and UID	FSC	FSR	FSU
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	M
CR Image	11.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O
DX Image - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
DX Image - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O
		Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14	O	M	O

		(selection value 1) 1.2.840.10008.1.2.4.70			
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
MG Image - For Presentation	11.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		JPEG Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG Lossy 1.2.840.10008.1.2.91	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
MG Image - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
IOX Image - For Presentation	11.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG Lossy	O	O	O

		1.2.840.10008.1.2.91			
IOX Image - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
CT Image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
US-MF image (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	-	M	-
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	M	-

		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	-	M	-
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	-	M	-
		RLE Lossless 1.2.840.10008.1.2.5	-	M	-
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	-	M	-
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	-	M	-
US-MF image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	M	O
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.90	O	O	O
Enhanced MR Image	1.2.840.10008.5.1.4.1.1.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O

		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
US Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	-	M	-
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	-	M	-
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	-	M	-
		RLE Lossless 1.2.840.10008.1.2.5	-	M	-
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	-	M	-
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	-	M	-
US Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	M	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	M	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	M	O
SC Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O

Multi-frame Single Bit Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
Multi-frame Grayscale Byte Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
Multi-frame Grayscale Word Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.3 1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O

		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
Multi-frame True Color Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		JPEG Lossless, Process 14, Non-HIER 1.2.840.10008.1.2.4.57	-	M	-
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91	O	O	O
Waveform Storage SOP Classes	1.2.840.10008.5.1.4.1.1.9.1.1 1.2.840.10008.5.1.4.1.1.9.1.2 1.2.840.10008.5.1.4.1.1.9.1.3 1.2.840.10008.5.1.4.1.1.9.2.1 1.2.840.10008.5.1.4.1.1.9.3.1 1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
Waveform Storage SOP Classes	1.2.840.10008.5.1.4.1.1.9.1.1 1.2.840.10008.5.1.4.1.1.9.1.2 1.2.840.10008.5.1.4.1.1.9.1.3 1.2.840.10008.5.1.4.1.1.9.2.1 1.2.840.10008.5.1.4.1.1.9.3.1 1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.1	O	M	O
X-X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	M	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	M	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	M	O
X-Ray Radio-flouroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14	O	M	O

		(selection value 1) 1.2.840.10008.1.2.4.70			
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	M	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	M	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.91	O	M	O
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.91	O	O	O
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed	O	M	O

		1.2.840.10008.1.2.2			
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Chest CAD SR	1.2.840.10008.5.1.4.1.1.88.65	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless 1.2.840.10008.1.2.90	O	O	O
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
		RLE Lossless 1.2.840.10008.1.2.5	O	O	O
		JPEG 2000 Lossless	O	O	O

		1.2.840.10008.1.2.90			
		JPEG 2000 Lossy 1.2.840.10008.1.2.91	O	O	O
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Brachy Treatment Record	1.2.840.10008.5.1.4.1.1.481.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Ion Plan	1.2.840.10008.5.1.4.1.1.481.8	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Ion Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.9	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Csa Non-Image	1.3.12.2.1107.5.9.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	O	M	O

FSC, FSR, FSU - denote the requirement for those roles

O - Optional
M - Mandatory

3.4.3.2 Physical Media Formats

The PRI-SYNGO-CD Profile requires the 120mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

The PRI-SYNGO-DVD Profile requires the 120mm DVD-R physical media with the UDF 2.01 Media Format, as defined in PS3.12.

3.4.3.3 Directory Information in DICOMDIR

Conforming Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File Set. All DICOM files in the File Set incorporating SOP instances defined for the specific Application Profile shall be referenced by Directory Records.

Note:
DICOMDIRs with no directory information are not allowed by this Application Profile.

Privately defined IODs will be referenced by "PRIVATE" Directory Records.

3.4.3.3.1 Basic Directory IOD Specification

This Application Profile makes use of optional attributes of the Basic Directory IOD to support recognition of Patient's Storage Service request results in spanning multiple volumes (file sets). Therefore the File Set Descriptor File can be used and is then referenced by optional Basic Directory IOD attributes. If existent, the specified Descriptor File may be used by FSR applications. Any FSU, FSC shall make a clear statement if the Descriptor File mechanism is used according to the specialization defined in this Application Profile.

The Descriptor Files shall have the following contents:

One single line without any control characters and according to the Basic Character Set having the following defined text:

"MULTIVOLUME: xx of yy"

xx, yy are replaced by the actual number of the volume (xx) and the total number of volumes in the set (yy).

If used, the Descriptor File shall have the File ID "README" and reside in the same directory level as the DICOMDIR. It is referenced by the attribute [0004,1141] File Set Descriptor File ID having the defined contents of "README".

3.4.3.3.2 Additional Keys

File Set Creators and Updaters are required to generate the mandatory elements specified in PS 3.3, Annex F of the DICOM Standard. Table below: PRI-SYNGO-CD Additional DICOMDIR Keys specifies the additional associated keys. At each directory record level other additional data elements can be added, but it is not required that File Set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS 3.3.

Table 67: DICOMDIR keys

Attribute Name	Tag	Directory Record Level	Type	Notes
Date Of Birth	(0010,0030)	PATIENT	2C	required, if present in SOP Instance
Patient's Sex	(0010,0040)	PATIENT	2C	required, if present in SOP Instance
Series Date	(0008,0021)	SERIES	3	
Series Time	(0008,0031)	SERIES	3	
Institution name	(0008,0080)	SERIES	2C	required, if present in SOP Instance
Institution Address	(0008,0081)	SERIES	2C	required, if present in SOP Instance

Series Description	(0008,103E)	SERIES	3	
Performing Physician's Name	(0008,1050)	SERIES	2C	required, if present in SOP Instance
Image Type	(0008,0008)	IMAGE	1C	required, if present in SOP Instance
SOP Class UID	(0008,0016)	IMAGE	3	
SOP Instance UID	(0008,0018)	IMAGE	3	
Content Date	(0008,0023)	IMAGE	3	
Content Time	(0008,0033)	IMAGE	3	
Referenced Image Sequence	(0008,1140)	IMAGE	1C	required, if present in SOP Instance
> Referenced SOP Class UID	(0008,1150)			
> Referenced SOP Instance UID	(0008,1155)			
Image Position (Patient)	(00020,0032)	IMAGE	2C	required, if present in SOP Instance
Image Orientation (Patient)	(0020,0037)	IMAGE	2C	required, if present in SOP Instance
Frame Of Reference UID	(0020,0052)	IMAGE	2C	required, if present in SOP Instance
Rows	(0028,0010)	IMAGE	3	
Columns	(0028,0011)	IMAGE	3	
Pixel Spacing	(0028,0030)	IMAGE	1C	C
Calibration Image	(0050,0004)	IMAGE	2C	required, if present in SOP Instance
Icon Image Sequence	(0088,0200)	IMAGE	3	required for Image SOP Classes
> Samples per Pixel	(0028,0002)			1
> Photometric Interpretation	(0028,0004)			MONOCHROME2
> Rows	(0028,0010)			128 for XA IOD, 64 otherwise
> Columns	(0028,0011)			128 for XA IOD, 64 otherwise
> Bits Allocated	(0028,0100)			8
> Bits Stored	(0028,0101)			8
> High Bit	(0028,0102)			7
> Pixel Representation	(0028,0103)			0 (unsigned)
> Pixel Data	(7FE0,0010)			Icon Image pixel data
Curve Number	(0020,0024)	CURVE	1C	required, if present in SOP Instance

Private Directory Records are supported by this Application Profile Class at the following level: IMAGE

The PRIVATE Directory Records will have required elements in addition to the mandatory elements specified in PS 3.3.

The following table will list the additional required keys for PRIVATE Directory Records.

Table 68: DICOMDIR keys for CSANonImage

Attribute Name	Tag	Directory Record Level	Type	Notes
Private Record UID	(0004,1432)	PRIVATE	1	See Conformance Statement
SOP Class UID	(0008,0016)	PRIVATE	1C	required, if present in SOP Instance
SOP Instance UID	(0008,0018)	PRIVATE	1C	required, if present in SOP Instance
Image Type	(0008,0008)	PRIVATE	3	identification characteristics
Acquisition Date	(0008,0022)	PRIVATE	3	
Acquisition Time	(0008,0032)	PRIVATE	3	
Acquisition Number	(0020,0012)	PRIVATE	3	
CSA Data Type	(0029,xx08)	PRIVATE	1	private owner code = SIEMENS CSA NON-IMAGE
CSA Data Version	(0029,xx09)	PRIVATE	3	private owner code = SIEMENS CSA NON-IMAGE

3.4.3.3.3 Icon Image Sequence

Directory Records of type SERIES or IMAGE may include Icon Images. The Icon Image Pixel data shall be as specified in PS 3.3 "Icon Image Key Definition", and restricted such, that Bits Allocated (0028,0100) and Bits Stored (0028,0101) shall be equal to 8, and Rows (0028,0010) and Columns (0028, 0011) shall be equal to 128 for XA Images and 64 for all other images. The Photometric interpretation (0028,0004) shall always be restricted to "MONOCHROME2".

PRIVATE Directory Records will not contain Icon Image information.

3.4.3.4 Other Parameters

This section defines other parameters common to all specific Application Profiles in the PRI-SYNGO class which need to be specified in order to ensure interoperable media interchange.

3.4.3.4.1 Multiframe JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames

3.5 Media Configuration

3.5.1 AE Title Mapping

3.5.1.1 DICOM Media Storage AE Title

The DICOM Storage application (Image Manager) provides the application entity title: CsaImageManager

4 Transformations of DICOM to CDA

N/A

5 Support of Extended Character Sets

The Biograph mCT DICOM application supports the following character sets as defined in the following tables below:

Table 69: Single-Byte Character Sets without Code Extension

Character Set Description	Defined Term	ISO registration number	Character Set
Default repertoire	none	ISO_IR 6	ISO 646:
Latin alphabet No. 1	ISO_IR 100	ISO_IR 100	Supplementary set
		ISO_IR 6	ISO 646:
Latin alphabet No. 2	ISO_IR 101	ISO_IR 101	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 3	ISO_IR 109	ISO_IR 109	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 4	ISO_IR 110	ISO_IR 110	Supplementary set
		ISO_IR 6	ISO 646
Cyrillic	ISO_IR 144	ISO_IR 144	Supplementary set
		ISO_IR 6	ISO 646
Arabic	ISO_IR 127	ISO_IR 127	Supplementary set
		ISO_IR 6	ISO 646
Greek	ISO_IR 126	ISO_IR 126	Supplementary set
		ISO_IR 6	ISO 646
Hebrew	ISO_IR 138	ISO_IR 138	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 5	ISO_IR 148	ISO_IR 148	Supplementary set
		ISO_IR 6	ISO 646
Japanese	ISO_IR 13	ISO_IR 13	JIS X 0201: Katakana
		ISO_IR 14	JIS X 0201: Romaji

Table 70: Single-Byte Characters Sets with Code Extension

Character Set Description	Defined Term	Standard for Code Extension	ESC sequence	ISO registration number	Character Set
Default repertoire	ISO 2022 IR 6	ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.1	ISO 2022 IR 100	ISO 2022	ESC 02/13 04/01	ISO-IR 100	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.2	ISO 2022 IR 101	ISO 2022	ESC 02/13 04/02	ISO-IR 101	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.3	ISO 2022 IR 109	ISO 2022	ESC 02/13 04/03	ISO-IR 109	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.4	ISO 2022 IR 110	ISO 2022	ESC 02/13 04/04	ISO-IR 110	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Cyrillic	ISO 2022 IR 144	ISO 2022	ESC 02/13 04/12	ISO-IR 144	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Arabic	ISO 2022 IR 127	ISO 2022	ESC 02/13 04/07	ISO-IR 127	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Greek	ISO 2022 IR 126	ISO 2022	ESC 02/13 04/06	ISO-IR 126	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Hebrew	ISO 2022 IR 138	ISO 2022	ESC 02/13 04/08	ISO-IR 138	Supplementary set
		ISO 2022	ESC 02/13 04/02	ISO-IR 6	ISO 646
Latin alphabet No. 5	ISO 2022 IR 148	ISO 2022	ESC 02/13 04/13	ISO-IR 148	Supplementary set
		ISO 2022	ESC 02/13 04/02	ISO-IR 6	ISO 646
Japanese	ISO 2022 IR 13	ISO 2022	ESC 02/13 04/09	ISO-IR 13	JIS X 0201: Katakana
		ISO 2022	ESC 02/13 04/10	ISO-IR 14	JIS X 0201-1976: Romaji

Table 71: Multi-Byte Character Set without Code Extension

Character Set Description	Defined Term	ISO registration number	Character Set
Unicode	ISO_IR 192	ISO 10646	Unicode in UTF-8
Chinese	GB18030	GB18030	GB 18030-2000 (China Association for Standardization)

Table 72: Multi-Byte Character Sets with Code Extension

Character Set Description	Defined Term	Standard for Code Extension	ESC sequence	ISO registration number	Character Set
Japanese	ISO 2022 IR 87	ISO 2022	ESC 02/04 04/02	ISO-IR 87	JIS X 0208: Kanji
	ISO 2022 IR 159	ISO 2022	ESC 02/04 02/08 04/04	ISO-IR 159	JIS X 0212: Supplementary Kanji set
Chinese[a]	ISO 2022 IR 58	ISO 2022	ESC 02/04 04/01	ISO-IR 58	GB2312-80 (China Association for Standardization)

a. This Character Set is an extension of DICOM for the Chinese language.

When there is a mismatch between the SCS tags (0008,0005) and the characters in an IOD received by the system, then the following measures are taken to make the characters DICOM conform:

- Try to import with ISO_IR 100. If ISO_IR 100 fails, convert each illegal character to a '?'.

There are now three categories of character sets which have to be differentiated because of their different encoding formats:

- Conventional ISO character sets: ISO_IR 6, ISO 2022 IR 6, ISO_IR 100, etc., encoded in ISO 2022
- ISO_IR 192 encoded in UTF-8
- GB18030 encoded in GB18030

It is not possible to recognize the following mismatches automatically on receiving or importing:

- An attribute value is encoded in ISO_IR 192(0008,0005) contains a conventional ISO character set as primary character set
- An attribute value is encoded in GB18030(0008,0005) contains a conventional ISO character set as primary character set
- An attribute value is encoded in ISO 2022 (0008,0005) contains ISO_IR 192
- An attribute value is encoded in ISO 2022←→(0008,0005) contains GB18030

An IOD that contains one of the above mentioned inconsistencies is not DICOM conformant. As these kinds of inconsistencies cannot be recognized by the system, the IOD will not be rejected but the character data might be corrupted.

Older versions of syngo do not support the newly introduced character sets ISO_IR 192 and GB18030 and their special encodings. That means, an IOD which contains one of these new character sets in (0008,0005) will be rejected by an older syngo system.

6 Attribute confidentiality profiles

6.1 N/A

7 Security

Syngo allows the use of either a conventional (non-secure) DICOM communication or a secure DICOM communication. For secure DICOM communication syngo application uses Transport Layer Protocol (TLS v1.0). Following features are supported for the secure DICOM communication. The port in which syngo act as SCP for secure DICOM communication is 2762 (fixed). The port in which syngo act as SCP for unsecure DICOM communication is 104 (fixed). By default unsecure mode is not available.

The following security profile are done in syngo using TLS 1.0 protocol

- Secure authentication of node
- Integrity and confidentiality of transmitted data.
- Generation of audit trail records access control and user authentication.

7.1 Security Profiles

syngo conforms to the Basic TLS Transport Connection Profile.

syngo initiates the TLS connections and accepts TLS connections with Storage commitment. syngo provides an configuration panel by which local systems can configure the certificate that needs to bind for DICOM communication. Secure communication is a “mode of operation” of syngo supported by the implementation of the DICOM Basic TLS Secure Transport Connection Profile. This functionality will be used by the nodes that can authenticate each other before they exchange DICOM information. For secure communication the TLS protocol v1.0 is used which provides message authentication, integrity and confidentiality.

syngo supports X.509 certificates. The type of X.509 certificates that are supported in syngo are

1) Self Signed certificate
2) Certificate for which chain building (Trusted chain building, Trusted CA) is possible.

The following TLS certification checks will be done (TLS Handshake). The machine (either server or client) that will send its certificate will :

- Choose the certificate according to Common Name (CN), if the syngo self signed is used. If customer specific certificate needs to be used then Serial Number of the certificate is used for choosing the certificate.

The server verifies

- that the client certificate is X.509 certificate which in not tampered with
- that the client certificate is in the list of trusted certificates (Trust Chain Building)
- that the client certificate is not in the revoked list.
- that the client certificate is not expired (present time is between “Valid From” and “Valid To” fields of X.509 certificate)
- that the client certificate has the correct purpose (at least the client authentication purpose).
- The client verifies
- that the server certificate is a X.509 certificate which is not tampered with
- that the server certificate is in the list of trusted certificates (Trust Chain Building)
- that the server certificate is not in the revoked list.
- that the server certificate is not expired (present time is between “Valid From” and “Valid To” fields of X.509 certificate)
- that the server certificate has the correct purpose (at least the server authentication purpose).

In addition the following validation is done at syngo side

1) 'Direct certificate validation' for self-signed certificate, i.e. the self-signed certificate of the remote node must be present in the 'Trusted Root Certificate' Store. Certificates received from peer have multiple X.509 certificates within the TLS Handshake.
2) syngo can receive X.509 certificate chain in the TLS handshake from peer, the Trust chain Building shall be done for the remaining certificates which are not present in the TLS Handshake and the root certificate must be available in the 'Trusted Root Certificates' store

The X.509 certificate imported and used for DICOM communication

1) must have purpose set for Client and Server Authentication.
2) must be exportable to generate the certificate file and private key file.

If intermediate and root X.509 certificates are present then the intermediate certificate must be imported to Intermediate Certificate Authorities→Certificates. The root certificate must be imported to the Trusted Root Certificates→Certificates.

syngo communicates with either of the following Cipher suites for encrypting the data send across the network.

TLS_RSA_WITH_AES_128_CBC_SHA

TLS_RSA_WITH_3DES_EDE_CBC_SHA

Note: Support for NULL Cipher (TLS_RSA_WITH_NULL_SHA) is not there. The secure communication is FIPS mode enabled

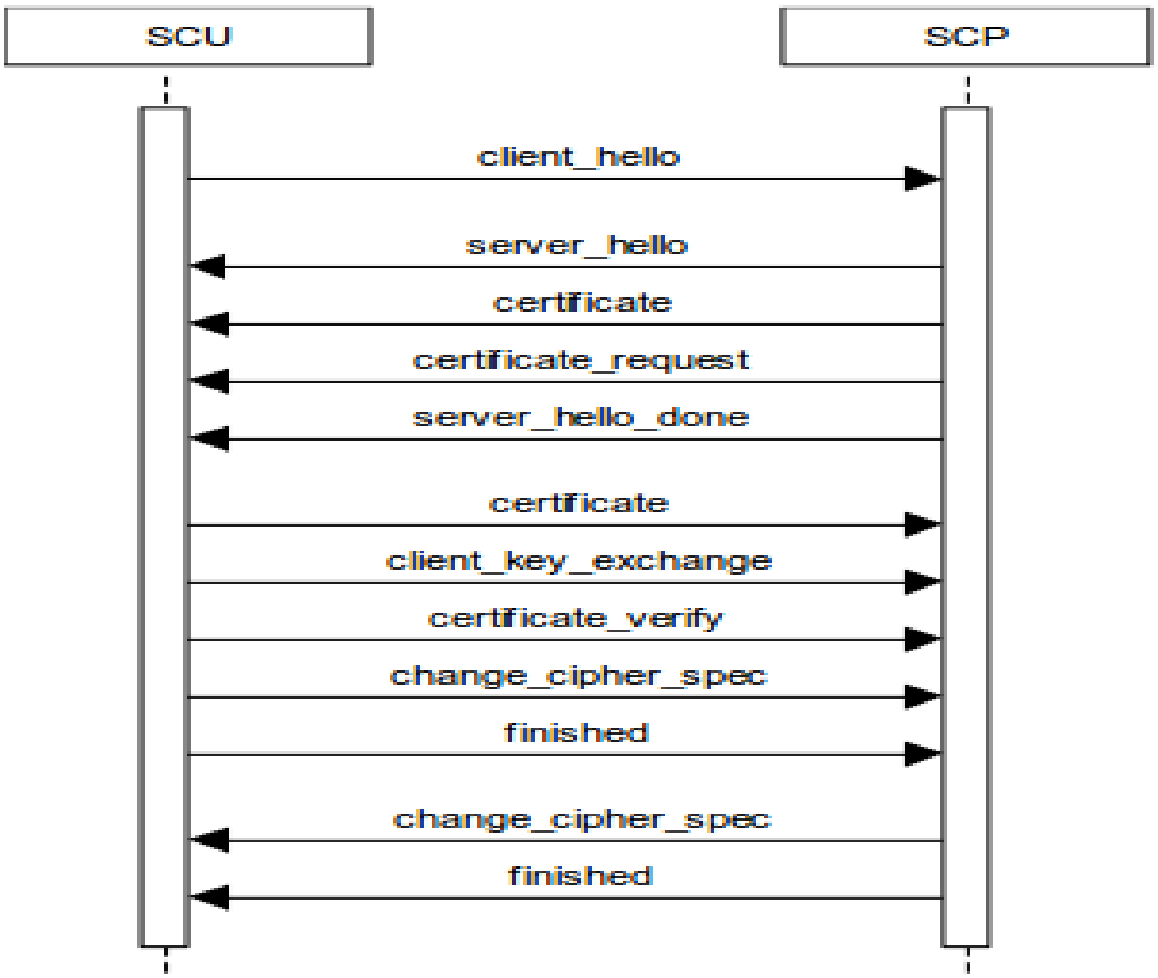


Figure 1: TLS Handshake Message Protocol

7.2 Association Level Security

N/A

7.3 Application Level Security

N/A

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instances

The following SOP instances are created by the Biograph Horizon (details regarding each are in the sections below):

- 8.1.1.2 CT Image IOD
- 8.1.1.3 Secondary Capture Image IOD
- 8.1.1.4 Positron Emission Tomography Image IOD
- 8.1.1.5 Radiation Dose SR IOD

Throughout the following sections, the tables use a number of abbreviations. The abbreviations used in the "Presence" column are

- VNAP: Value is Not Always Present. Attribute is sent zero length if no value is present.
- ANAP: Attribute Not Always Present.
- ALWAYS: Attribute and Value are always present.
- EMPTY: Attribute is sent zero length.

The abbreviations used in the "Source" Column are

- MWL: The attribute value is copied from Modality Worklist.
- USER: The attribute value is entered by the user.
- AUTO: The attribute value is generated by the system.
- CONFIG: The attribute value is obtained by configuration

8.1.1.1 Common Modules

The following modules are common for multiple IODs. If a module does use such common module, then it will reference to the following sub-chapters and tables.

8.1.1.1.1 Module Patient (Common for CTImage, SecondaryCaptureImage)

Table 73 lists all attributes that are supported in the Patient Module for the IODs:

- CT Image
- Secondary Capture Image

Table 73: Patient Module Attributes

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Patient's Name	(0010,0010)	PN	MWL, USER, AUTO		ALWAYS	1)
Patient ID	(0010,0020)	LO	MWL, USER, AUTO		ALWAYS	1)

Issuer of Patient ID	(0010,0021)	LO	MLW		ANAP	
Patient's Birth Date	(0010,0030)	DA	MWL, USER	Format: YYMMDD	VNAP	
Patient's Sex	(0010,0040)	CS	MWL, USER	M,F,O	VNAP	
Referenced Patient Sequence	(0008,1120)	SQ	MWL		ANAP	
> Referenced SOP Class UID	(0008,1150)	UI	MWL		ALWAYS	
> Referenced SOP Instance UID	(0008,1155)	UI	MWL		ALWAYS	
Other Patient IDs (RETIRED)	(0010,1000)	LO	MWL		ANAP	

1) In case of "emergency patient" the attributes PatientID and PatientName are filled with a device generated value which contains a time-stamp.

8.1.1.1.2 Module General Study (Common for CTImage, SecondaryCaptureImage)

Table 74 lists all attributes that are supported in the General Study Module for the IODs:

- CT Image
- Secondary Capture Image

Table 74: General Study Module Attributes

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Study Instance UID	(0020,000D)	UI	MWL, AUTO	From MWL or "1.3.12.2.1107.5.1.4." +UID	ALWAYS	
Study Date	(0008,0020)	DA	AUTO	Format: YYMMDD	ALWAYS	
Study Time	(0008,0030)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Referring Physician's Name	(0008,0090)	PN	MWL		VNAP	
Study ID	(0020,0010)	SH	MWL, AUTO		VNAP	
Accession Number	(0008,0050)	SH	MWL		VNAP	
Study Description	(0008,1030)	LO	MWL, AUTO, CONFIG		ANAP	
Physician(s) of Record	(0008,1048)	PN	MWL		ANAP	
Requesting Service	(0032,1033)	LO	MWL		ANAP	
Referenced Study Sequence	(0008,1110)	SQ	MWL		ANAP	
>Referenced SOP Class UID	(0008,1150)	UI	MWL		ALWAYS	
>Referenced SOP Instance UID	(0008,1155)	UI	MWL		ALWAYS	
Procedure Code Sequence	(0008,1032)	SQ	MWL		ANAP	
>Code Value	(0008,0100)	SH	MWL		ALWAYS	
>Coding Scheme Designator	(0008,0102)	SH	MWL		ALWAYS	
>Code Meaning	(0008,0104)	LO	MWL		ALWAYS	

8.1.1.1.3 Module Patient Study (Common for CTImage, SecondaryCaptureImage)

Table 75 lists all attributes that are supported in the Patient Study Module for the IODs:

- CT Image
- Secondary Capture Image

Table 75: Patient Study Module Attributes

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Patient's Age	(0010,1010)	AS	AUTO		ALWAYS	Calc from birthdate and current date/time
Patient's Size	(0010,1020)	DS	MWL		ANAP	
Patient's Weight	(0010,1030)	DS	MWL	(in kg)	ANAP	
Pregnancy Status	(0010,21C0)	US	MWL	1,2,3,4	ANAP	
Additional Patient History	(0010,21B0)	LT	MWL		ANAP	

8.1.1.2 CT Image IOD

The following table specifies the Modules supported in the CT Image IOD

Table 76: CT Image IOD Modules

IE	Module	Reference (in this document)	Presence of Module
Patient	Patient	Table 73	ALWAYS
Study	General Study	Table 74	ALWAYS
	Patient Study		ALWAYS
Series	General Series	Table 77	ALWAYS
Frame of Reference	Frame of Reference	Table 78	ALWAYS
Equipment	General Equipment	Table 79	ALWAYS
Image	General Image	Table 80	ALWAYS
	General Reference	Table 81	C – Not used for Topogram
	Image Plane	Table 82	ALWAYS
	Image Pixel	Table 83	ALWAYS
	Contrast/Bolus	Table 84	C – If contrast media was used in this image
	CT Image	Table 85	ALWAYS
	Overlay Plane	Table 86	C – Not used for Topogram
	VOI LUT	Table 87	ALWAYS
	SOP Common	Table 88	ALWAYS
	Extension attributes	Table 89	ALWAYS

8.1.1.2.1 Module General Series (CT Image)

Table 77 lists all attributes that are supported in the General Series Module for the CT Image IOD.

Table 77: General Series Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Modality	(0008,0060)	CS	AUTO	"CT"	ALWAYS	
Series Instance UID	(0020,000E)	UI	AUTO	"1.3.12.2.1107.5.1.4." +UID	ALWAYS	
Series Number	(0020,0011)	IS	AUTO	1 – N	ALWAYS	
Laterality	(0020,0060)	CS	AUTO	"R", "L"	ANAP	
Series Date	(0008,0021)	DA	AUTO	Format: YYMMDD	ALWAYS	
Series Time	(0008,0031)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Protocol Name	(0018,1030)	LO	AUTO, CONFIG	Example: "Onco_LowDose"	ALWAYS	
Series Description	(0008,103E)	LO	AUTO, CONFIG		ALWAYS	
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	MPPS			If MPPS
>Referenced SOP Class UID	(0008,1150)	UI	MPPS	"1.2.840.10008.3.1.2.3.3" = MPPS SOP Class		
>Referenced SOP Instance UID	(0008,1155)	UI	MPPS			
Body Part Examined	(0018,0015)	CS	AUTO	See 8.5.1.1.2 Body Part Examined	ALWAYS	
Patient Position	(0018,5100)	CS	AUTO	See DICOM PS3.3 C.7.3.1.1.2 Patient Position	ALWAYS	
Request Attributes Sequence	(0040,0275)	SQ	MWL		ANAP	
>Requested Procedure ID	(0040,1001)	SH	MWL		ANAP	
>Scheduled Procedure Step ID	(0040,0009)	SH	MWL		ANAP	
>Scheduled Procedure Step Description	(0040,0007)	SH	MWL		ANAP	
>Scheduled Protocol Code Sequence	(0040,0008)	SQ	MWL		ANAP	
>>Code Value	(0008,0100)	SH	MWL		ANAP	
>>Coding Scheme Designator	(0008,0102)	SH	MWL		ANAP	
>>Code Meaning	(0008,0104)	LO	MWL		ANAP	

8.1.1.2.2 Module Frame of Reference (CT Image)

Table 78 lists all attributes that are supported in the Frame of Reference Module.

Table 78: Frame of Reference Module Attributes CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Frame of Reference UID	(0020,0052)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	
Position Reference Indicator	(0020,1040)	LO	AUTO	Position, or empty	VNAP	

8.1.1.2.3 Module General Equipment (CT Image)

Table 79 lists all attributes that are supported in the General Equipment Module for the CT Image IOD.

Table 79: General Equipment Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Manufacturer	(0008,0070)	LO	AUTO	"SIEMENS" [20]	ALWAYS	
Institution Name	(0008,0080)	LO	CONFIG		ALWAYS	
Institution Address	(0008,0081)	LO	CONFIG		ALWAYS	
Station Name	(0008,1010)	SH	CONFIG		ALWAYS	
Manufacturer's Model Name	(0008,1090)	LO	AUTO	One of the following based on system type: "Biograph20_mCT 3R" "Biograph20_mCT 4R" "Biograph40_mCT 3R" "Biograph40_mCT 4R" "Biograph64_mCT 3R" "Biograph64_mCT 4R" "Biograph128_mCT 3R" "Biograph128_mCT 4R" "Biograph128_mCT 3R Edge" "Biograph128_mCT 4R Edge"	ALWAYS	
Device Serial Number	(0018,1000)	LO	CONFIG		ALWAYS	
Software Versions	(0018,1020)	LO	AUTO	"VG80A"	ALWAYS	

[20] Will be replaced by "Siemens Healthineers" in future versions

Date of Last Calibration	(0018,1200)	DA	AUTO		ALWAYS	
Time of Last Calibration	(0018,1201)	TM	AUTO		ALWAYS	

8.1.1.2.4 Module General Image (CT Image)

Table 80 lists all attributes that are supported in the General Image Module for the CT Image IOD.

Table 80: General Image Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Instance Number	(0020,0013)	IS	AUTO	1 – N	ALWAYS	
Patient Orientation	(0020,0020)	CS	AUTO		ANAP	
Content Date	(0008,0023)	DA	AUTO	Format: YYMMDD	ALWAYS	
Content Time	(0008,0033)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Image Type	(0008,0008)	CS	AUTO	See below	ALWAYS	
Acquisition Number	(0020,0012)	IS	AUTO	1 – N	ALWAYS	
Acquisition Date	(0008,0022)	DA	AUTO	Format: YYMMDD	ALWAYS	
Acquisition Time	(0008,0032)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Acquisition DateTime	(0008,002A)	DT	AUTO	Format: YYMMDDhhmmss.nnnnn	ALWAYS	
Image Comments	(0020,4000)	LT	USER		VNAP	
Lossy Image Compression	(0028,2110)	CS	AUTO, CONFIG	00 = No 01 = Yes	ANAP	not for Topogram
Irradiation Event UID	(0008,3010)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	
Image Laterality	(0020,0062)	CS	AUTO		ANAP	

Values for ImageType

(0008,0008) ImageType
ORIGINAL\PRIMARY\LOCALIZER\CT_SOM5 TOP
DERIVED\PRIMARY\AXIAL\CT_SOM5 SPI

8.1.1.2.5 Module General Reference (CT Image)

Table 81 lists all attributes that are supported in the General Reference Module for the CT Image IOD.

Table 81: General Reference Module Attributes

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Referenced Image Sequence	(0008,1140)	SQ	AUTO		ANAP	Not present for topogram
> Referenced SOP Class UID	(0008,1150)	UI	AUTO	1.2.840.10008.5.1.4.1.1.2 =CTImageStorage	ALWAYS	
> Referenced SOP Instance UID	(0008,1155)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	Reference to (0008,0018) SOPInstance UID of topogram in the study
Derivation Description	(0008,2111)	ST	AUTO		ANAP	
Source Image Sequence	(0008,2112)	SQ	AUTO		ANAP	Not present for topogram
> Referenced SOP Class UID	(0008,1150)	UI	AUTO	1.2.840.10008.5.1.4.1.1.2 =CTImageStorage	ALWAYS	
> Referenced SOP Instance UID	(0008,1155)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	Reference to (0008,3010) IrradiationEventUID of the study

8.1.1.2.6 Module Image Plane (CT Image)

Table 82 lists all attributes that are supported in the Image Plane Module for the CT Image IOD.

Table 82: Image Plane Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Pixel Spacing	(0028,0030)	DS	AUTO	N\N	ALWAYS	
Image Orientation (Patient)	(0020,0037)	DS	AUTO	N\N\N\N\N\N	ALWAYS	
Image Position (Patient)	(0020,0032)	DS	AUTO	N\N\N	ALWAYS	
Slice Thickness	(0018,0050)	DS	AUTO		VNAP	Empty for topogram
Slice Location	(0020,1041)	DS	AUTO	N	ALWAYS	

8.1.1.2.7 Module Image Pixel (CT Image)

Table 83 lists all attributes that are supported in the Image Pixel Module.

Table 83: Image Pixel Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Samples per Pixel	(0028,0002)	US	AUTO	1	ALWAYS	
Photometric Interpretation	(0028,0004)	CS	AUTO	"MONOCHROME2"	ALWAYS	
Rows	(0028,0010)	US	AUTO	"512"	ALWAYS	
Columns	(0028,0011)	US	AUTO	"512"	ALWAYS	
Bits Allocated	(0028,0100)	US	AUTO	"16"	ALWAYS	
Bits Stored	(0028,0101)	US	AUTO	"12"	ALWAYS	
High Bit	(0028,0102)	US	AUTO	"11"	ALWAYS	
Pixel Representation	(0028,0103)	US	AUTO	"0" =unsigned integer	ALWAYS	
Smallest Image Pixel Value	(0028,0106)	US	AUTO		ANAP	Not present for Topogram
Largest Image Pixel Value	(0028,0107)	US	AUTO		ANAP	Not present for Topogram
Pixel Data	(7FE0,0010)	OW	AUTO		ALWAYS	

8.1.1.2.8 Module Contrast/Bolus (CT Image)

Table 84 lists all attributes that are supported in the Contrast/Bolus Modul for the CT Image IOD.
This module is present, if contrast media was used in this image

Table 84: Contrast/Bolus Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Contrast/Bolus Agent	(0018,0010)	LO	AUTO, USER?	Examples: "APPLIED" "IMERON"	ALWAYS	
Contrast/Bolus Volume	(0018,1041)	DS	AUTO		ALWAYS	
Contrast Flow Rate	(0018,1046)	DS	AUTO		ALWAYS	
Contrast Flow Duration	(0018,1047)	DS	AUTO		ALWAYS	
Contrast/Bolus Ingredient Concentration	(0018,1049)	DS	AUTO		ALWAYS	

8.1.1.2.9 Module CT Image (CT Image)

Table 85 lists all attributes that are supported in the CT Image Module.

Table 85: CT Image Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Image Type	(0008,0008)	CS	AUTO	See Section 8.5.1.1.1	ALWAYS	

				(Image Type) and Table 160 for further explanation.		
Samples per Pixel	(0028,0002)	US	AUTO	"1"	ALWAYS	
Photometric Interpretation	(0028,0004)	CS	AUTO	"MONOCHROME2"	ALWAYS	
Bits Allocated	(0028,0100)	US	AUTO	"16"	ALWAYS	
Bits Stored	(0028,0101)	US	AUTO	"12"	ALWAYS	
High Bit	(0028,0102)	US	AUTO	"11"	ALWAYS	
Rescale Intercept	(0028,1052)	DS	AUTO	Example: "-1024"	ALWAYS	
Rescale Slope	(0028,1053)	DS	AUTO	"1"	ALWAYS	
Rescale Type	(0028,1054)	LO	AUTO	"HU"	ALWAYS	
KVP	(0018,0060)	DS	AUTO	Example: "120"	ALWAYS	
Acquisition Number	(0020,0012)	IS	AUTO	1 – N	ALWAYS	
Data Collection Diameter	(0018,0090)	DS	AUTO	Example: "500"	ALWAYS	
Data Collection Center (Patient)	(0018,9313)	FD	AUTO	N\N\N	ANAP	Not for Topogram
Reconstruction Diameter	(0018,1100)	DS	AUTO	Example: "1024"	ALWAYS	
Reconstruction Target Center (Patient)	(0018,9318)	FD	AUTO	N\N\N	ANAP	Not for Topogram
Distance Source to Detector	(0018,1110)	DS	AUTO		ALWAYS	
Distance Source to Patient	(0018,1111)	DS	AUTO		ALWAYS	
Gantry/Detector Tilt	(0018,1120)	DS	AUTO		ALWAYS	
Table Height	(0018,1130)	DS	AUTO	Example: "100"	ALWAYS	
Rotation Direction	(0018,1140)	CS	AUTO	"CW"	ALWAYS	
Exposure Time	(0018,1150)	IS	AUTO		ALWAYS	
X-Ray Tube Current	(0018,1151)	IS	AUTO		ALWAYS	
Exposure	(0018,1152)	IS	AUTO		ALWAYS	
Filter Type	(0018,1160)	SH	AUTO	Example: "FLAT"	ALWAYS	
Generator Power	(0018,1170)	IS	AUTO		ALWAYS	
Focal Spot(s)	(0018,1190)	DS	AUTO		ALWAYS	
Convolution Kernel	(0018,1210)	SH	AUTO	Examples: "Tr60f", "Br38f"	ALWAYS	
Single Collimation Width	(0018,9306)	FD	AUTO		ALWAYS	
Total Collimation Width	(0018,9307)	FD	AUTO		ALWAYS	
Table Speed	(0018,9309)	FD	AUTO		ALWAYS	
Table Feed per Rotation	(0018,9310)	FD	AUTO		ANAP	Not for Topogram

Spiral Pitch Factor	(0018,9311)	FD	AUTO		ALWAYS	
Exposure Modulation Type	(0018,9323)	CS	AUTO	Examples: “NONE”, “XYZ_EC”	ALWAYS	
CTDI vol	(0018,9345)	FD	AUTO		ALWAYS	
CTDI Phantom Type Code Sequence	(0018,9346)	SQ	AUTO		ALWAYS	
>Code Value	(0008,0100)	SH	AUTO	“113691”	ALWAYS	
>Coding Scheme Designator	(0008,0102)	SH	AUTO	“DCM”	ALWAYS	
>Code Meaning	(0008,0104)	LO	AUTO	“IEC Body Dosimetry Phantom”	ALWAYS	
Calcium Scoring Mass Factor Device	(0018,9352)	FL	AUTO	Num \ num \ num	ALWAYS	

8.1.1.2.10 Module Overlay Plane (CT Image)

Table 86 lists all attributes that are supported in the Overlay Plane Module. This module is not present if the CT image is a topogram. The overlay is usually placed in the (6000,eeee) group.

Table 86: Overlay Plane Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Overlay Rows	(60xx,0010)	US	AUTO	“512”	ALWAYS	
Overlay Columns	(60xx,0011)	US	AUTO	“512”	ALWAYS	
Overlay Type	(60xx,0040)	CS	AUTO	“G” = Graphics	ALWAYS	
Overlay Origin	(60xx,0050)	SS	AUTO	“1\1”	ALWAYS	
Overlay Bits Allocated	(60xx,0100)	US	AUTO	“1”	ALWAYS	
Overlay Bit Position	(60xx,0102)	US	AUTO	“0”	ALWAYS	
Overlay Data	(60xx,3000)	OW	AUTO		ALWAYS	
Overlay Description	(60xx,0022)	LO	AUTO	“Siemens MedCom Object Graphics”	ALWAYS	

8.1.1.2.11 Module VOI LUT (CT Image)

Table 87 lists all attributes that are supported in the VOI LUT Module.

Table 87: VOI LUT Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Window Center	(0028,1050)	DS	AUTO	N \ N	ALWAYS	
Window Width	(0028,1051)	DS	AUTO	N \ N	ALWAYS	
Window Center & Width Explanation	(0028,1055)	LO	AUTO	“WINDOW1\ WINDOW2	ALWAYS	

8.1.1.2.12 Module SOP Common (CT Image)

Table 88 lists all attributes that are supported in the SOP Common Module.

Table 88: SOP Common Module Attributes – CT Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
SOP Class UID	(0008,0016)	UI	AUTO	1.2.840.10008.5.1.4.1.1.2 =CTImageStorage	ALWAYS	
SOP Instance UID	(0008,0018)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	
Specific Character Set	(0008,0005)	CS	CONFIG MWL		ALWAYS	
Instance Number	(0020,0013)	IS	AUTO	1 – N	ALWAYS	

8.1.1.2.13 Extensions to CT Image IOD

Table 89 lists all attributes that are extensions for the IOD "CTImage".

Table 89: Extension attributes for IOD "CT Image"

Attribute Name	Tag	VR	Source	Value	Presence	Comments
RETIRED Other Patient IDs	(0010,1000)	LO	MWL		ANAP	Only if present on MWL
RETIRED Estimated Dose Saving	(0018,9324)	FD	AUTO	"0"	ALWAYS	For legacy reasons
Requesting Physician	(0032,1032)	PN	MWL		ANAP	Only if present on MWL
Requesting Service	(0032,1033)	LO	MWL		ANAP	Only if present on MWL
Requested Procedure Description	(0032,1060)	LO	MWL		ANAP	Only if present on MWL
Requested Procedure Code Sequence	(0032,1064)	LO	MWL		ANAP	Only if present on MWL
>Code Value	(0008,0100)	SH	MWL		ANAP	
>Coding Scheme Designator	(0008,0102)	SH	MWL		ANAP	
>Code Meaning	(0008,0104)	LO	MWL		ANAP	
Number of Frames in Overlay	(60xx,0015)	US	AUTO	"1"	ALWAYS	To be changed
Image Frame Origin	(60xx,0051)	US	AUTO	"1"	ALWAYS	To be changed

Notes:

- The attributes
  - OtherPatientIDs
  - RequestingPhysician
  - RequestingService
  - RequestedProcedureDescription
  - RequestedProcedureCodeSequence

  are used due to legacy reasons for existing customers.
  They may be removed in future versions of our implementation.
- The attribute EstimatedDoseSaving was retired in DICOM standard and is pending to be removed from our implementation

- The attributes NumberofFramesinOverlay and ImageFrameOrigin will be removed in future versions, as they are not needed for IOD CTImage, which is not a multi-frame.

8.1.1.3 Secondary Capture Image IOD

The IOD Secondary Capture is used for these purposes:

- CT X-Ray Dose information, as table in OverlayData
- PET Count Rate Statistics
- PET NAC Reconstruction Parameters
- PET AC Reconstruction Parameters
- PET Radiopharmaceutical Dose Report

They have parameter tables and drawings encoded as image pixels, respectively overlay pixels. As Secondary Capture Images are supported by most IHE Image Display providers, these data can be displayed as "image" – even if Structured Reports (SR) or other IODs cannot be displayed.

Table 90 specifies the Modules of the Secondary Capture Image IOD.

Table 90: Secondary Capture Image – IOD Modules

IE	Module	Reference (in this document)	Presence of Module
Patient	Patient	Table 73	ALWAYS
Study	General Study	Table 74	ALWAYS
	Patient Study	Table 75	ALWAYS
Series	General Series	Table 91	ALWAYS
Equipment	General Equipment	Table 92	ALWAYS
	SC Equipment	Table 93	ALWAYS
Acquisition	General Acquisition	n.a.	M = Mandatory, but contains only Type3 attributes. None of them are used.
Image	General Image	Table 94	ALWAYS
	Image Pixel	Table 95	ALWAYS
	SC Image	Table 96	ALWAYS
	Overlay Plane	Table 97	ALWAYS
	Modality LUT	Table 98	Present for "PET Statistics" Missing for "CT Patient Protocol"
	VOI LUT	Table 99	ALWAYS
	SOP Common	Table 100	ALWAYS
	Extension attributes	Table 101	ALWAYS

8.1.1.3.1 Module General Series – SC Image

Table 91 lists all attributes that are supported in the General Series Module for the Secondary Capture Image IOD.

Table 91: General Series Module Attributes – SC image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Modality	(0008,0060)	CS	AUTO	"PT"	ALWAYS	
Series Instance UID	(0020,000E)	UI	AUTO	"1.3.12.2.1107.5.1.4." +UID	ALWAYS	
Series Number	(0020,0011)	IS	AUTO	1 - N	ALWAYS	
Series Date	(0008,0021)	DA	AUTO	Format: YYMMDD	ALWAYS	
Series Time	(0008,0031)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Series Description	(0008,103E)	LO	AUTO	"Patient Protocol" "PET Statistics"	ALWAYS	See Note
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	MPPS		ANAP	If MPPS; not for "PET Statistics"
>Referenced SOP Class UID	(0008,1150)	UI	MPPS	1.2.840.10008.3.1.2.3.3 = MPPS SOP Class	ALWAYS	
>Referenced SOP Instance UID	(0008,1155)	UI	MPPS		ALWAYS	
Performed Procedure Step ID	(0040,0253)	DA	AUTO		ANAP	Not for "PET Statistics"
Performed Procedure Step Start Date	(0040,0244)	DA	AUTO		ANAP	Not for "PET Statistics"
Performed Procedure Step Start Time	(0040,0245)	TM	AUTO		ANAP	Not for "PET Statistics"

Note:
Series Description "Patient Protocol" = SC contains CT Dose information in OverlayData.
Series Description "PET Statistics" = SC contains PET Statistics as drawing in PixelData and values in OverlayData.

8.1.1.3.2 Module General Equipment – SC Image

Table 92 lists all attributes that are supported in the General Equipment Module, for the Secondary Capture IOD

Table 92: General Equipment Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Manufacturer	(0008,0070)	LO	AUTO	"SIEMENS"	ALWAYS	
Institution Name	(0008,0080)	LO	CONFIG		ANAP	Not present for PET Statistics
Institution Address	(0008,0081)	ST	CONFIG		ANAP	Not present for PET Statistics
Station Name	(0008,1010)	SH	CONFIG		ANAP	Not present for PET Statistics

Manufacturer's Model Name	(0008,1090)	LO	CONFIG		ANAP	Not present for PET Statistics
Device Serial Number	(0018,1000)	LO	CONFIG		ANAP	Not present for PET Statistics
Software Versions	(0018,1020)	LO	CONFIG		ANAP	Not present for PET Statistics

8.1.1.3.3 Module SC Equipment – SC Image

Table 93 lists all attributes that are supported in the General Equipment Module, for the Secondary Capture IOD.

Table 93: SC Equipment Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Conversion Type	(0008,0064)	LO	AUTO	"DRW" = Drawing	ALWAYS	Tables as pixel data
Modality	(0008,0060)	CS	AUTO	"PT"	ALWAYS	
Secondary Capture Device Manufacturer	(0018,1016)	LO	AUTO	"SIEMENS"	ANAP	Only present for "PET Statistics"

8.1.1.3.4 Module General Image – SC Image

Table 94 lists all attributes that are supported in the General Image Module for the Secondary Capture Image IOD.

Table 94: General Image Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Instance Number	(0020,0013)	IS	AUTO	"2000" = Count Rate Statistics "2002" = Recon Parameters	ALWAYS	Pseudo Instance No
Patient Orientation	(0020,0020)	CS	AUTO	(empty)	VNAP	Not useful for synthetic image
Content Date	(0008,0023)	DA	AUTO	Format: YYMMDD	ALWAYS	
Content Time	(0008,0033)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	
Image Type	(0008,0008)	CS	AUTO	"DERIVED\SECONDARY\OTHER"	ALWAYS	
Image Comments	(0020,4000)	LT	AUTO, USER	"PET Count Rate Statistics" "PET PET NAC Reconstruction Parameters" "PET PET AC Reconstruction Parameters"	ANAP	Not present for "Patient Statistics" user can change

8.1.1.3.5 Module Image Pixel – SC Image

Table 95 lists all attributes that are supported in the Image Pixel Module for the Secondary Capture Image IOD.

Table 95: Image Pixel Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Samples per Pixel	(0028,0002)	US	AUTO	1	ALWAYS	
Photometric Interpretation	(0028,0004)	CS	AUTO	"MONOCHROME2"	ALWAYS	
Rows	(0028,0010)	US	AUTO	"512"	ALWAYS	
Columns	(0028,0011)	US	AUTO	"512"	ALWAYS	
Bits Allocated	(0028,0100)	US	AUTO	"16"	ALWAYS	
Bits Stored	(0028,0101)	US	AUTO	"12"	ALWAYS	
High Bit	(0028,0102)	US	AUTO	"11"	ALWAYS	
Pixel Representation	(0028,0103)	US	AUTO	"0" =unsigned integer	ALWAYS	
Pixel Data	(7FE0,0010)	OW	AUTO		ALWAYS	See Note

Note:
"Patient Protocol" = SC contains CT Dose information in OverlayData. PixelData is has "black" pixels only.
"PET Statistics" = SC contains PET Statistics and ECG as drawing in PixelData, and parameters in OverlayData.

Table 96 lists all attributes that are supported in the Image Pixel Module for the Secondary Capture Image IOD.

Table 96: SC Image Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Date of Secondary Capture	(0018,1012)	DA	AUTO	Format: YYMMDD	ALWAYS	
Time of Secondary Capture	(0018,1014)	TM	AUTO	Format: hhmmss.nnnnn	ALWAYS	

8.1.1.3.6 Module Overlay Plane – SC Image

Table 97 lists all attributes that are supported in the Overlay Plane Module for the Secondary Capture IOD. The overlay is usually placed in the (6000,eeee) group.

Table 97: Overlay Plane Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Overlay Rows	(6000,0010)	US	AUTO	"512"	ALWAYS	
Overlay Columns	(6000,0011)	US	AUTO	"512"	ALWAYS	
Overlay Type	(6000,0040)	CS	AUTO	"G" = Graphics	ALWAYS	
Overlay Origin	(6000,0050)	SS	AUTO	"1\1"	ALWAYS	
Overlay Bits Allocated	(6000,0100)	US	AUTO	"1"	ALWAYS	
Overlay Bit Position	(6000,0102)	US	AUTO	"0"	ALWAYS	
Overlay Data	(6000,3000)	OW	AUTO		ALWAYS	See Note
Overlay Description	(6000,0022)	LO	AUTO	"Siemens MedCom Object Graphics"	ALWAYS	

Note:
"Patient Protocol" = SC contains CT Dose information in OverlayData.
"PET Statistics" = SC contains PET Statistics as drawing and ECG in PixelData, and parameters in OverlayData.

8.1.1.3.7 Module Modality LUT – SC Image

Table 98 lists all attributes that are supported in the Image Pixel Module for the Secondary Capture Image IOD.

Table 98: Modality LUT Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Rescale Intercept	(0028,1052)	DS	AUTO	"0"	ALWAYS	
Rescale Slope	(0028,1053)	DS	AUTO	"1"	ALWAYS	
Rescale Type	(0028,1054)	LO	AUTO	"US"	ALWAYS	

8.1.1.3.8 Module VOI LUT – SC Image

Table 99 lists all attributes that are supported in the VOL LUT Module for the Secondary Capture Image IOD.

Table 99: VOI LUT Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
Window Center	(0028,1050)	DS	AUTO	CT Pat Protocol: "200" PET Statistics: "2048"	ALWAYS	
Window Width	(0028,1051)	DS	AUTO	CT Pat Protocol: "50" PET Statistics: "512"	ALWAYS	

8.1.1.3.9 Module SOP Common – SC Image

Table 100 lists all attributes that are supported in the SOP Common Module.

Table 100: SOP Common Module Attributes – SC Image

Attribute Name	Tag	VR	Source	Value	Presence	Comments
SOP Class UID	(0008,0016)	UI	AUTO	1.2.840.10008.5.1.4.1.1.7 =SecondaryCaptureImageStorage	ALWAYS	
SOP Instance UID	(0008,0018)	UI	AUTO	"1.3.12.2.1107.5.1.4."+UID	ALWAYS	
Specific Character Set	(0008,0005)	CS	CONFIG MWL		ALWAYS	
Instance Number	(0020,0013)	IS	AUTO	"2000" = Count Rate Statistics "2002" = Recon Parameters	ALWAYS	Pseudo Instance No

8.1.1.3.10 Extension Attributes – SC Image

Table 101 lists all attributes that are extensions for the IOD "Secondary Capture Image".

Table 101: Extension attributes for IOD "Secondary Capture Image"

Attribute Name	Tag	VR	Source	Value	Presence	Comments
RETIRED Other Patient IDs	(0010,1000)	LO	MWL		ANAP	Only if present on MWL
Requesting Physician	(0032,1032)	PN	MWL		ANAP	Only if present on MWL
Requesting Service	(0032,1033)	LO	MWL		ANAP	Only if present on MWL
Requested Procedure Description	(0032,1060)	LO	MWL		ANAP	Only if present on MWL
Requested Procedure Code Sequence	(0032,1064)	LO	MWL		ANAP	Only if present on MWL
>Code Value	(0008,0100)	SH	MWL		ANAP	
>Coding Scheme Designator	(0008,0102)	SH	MWL		ANAP	
>Code Meaning	(0008,0104)	LO	MWL		ANAP	
Number of Frames in Overlay	(60xx,0015)	US	AUTO	"1"	ALWAYS	To be changed
Image Frame Origin	(60xx,0051)	US	AUTO	"1"	ALWAYS	To be changed

Notes:

- The attributes
  - OtherPatientIDs
  - RequestingPhysician
  - RequestingService
  - RequestedProcedureDescription
  - RequestedProcedureCodeSequence

  are used due to legacy reasons for existing customers.
  They may be removed in future versions of our implementation.
- The attributes NumberofFramesinOverlay and ImageFrameOrigin will be removed in future versions, as they are not needed for IOD Secondary Capture Image, which is not a multi-frame.

8.1.1.4 Positron Emission Tomography Image IOD

The following table specifies the Modules supported in the PET Image IOD.

Table 102: PET Image IOD Modules

IE	Module	Reference	Presence of Module
Patient	Patient Module	Table 103	ALWAYS
Study	General Study Module	Table 104	ALWAYS
	Patient Study Module	Table 105	ALWAYS
Series	General Series Module	Table 106	ALWAYS
	PET Series Module	Table 107	ALWAYS
	PET Isotope Module	Table 108	ALWAYS
	PET Multi-gated Acquisition Module	Table 109	Only for Gated
Frame of Reference	Frame of Reference Module	Table 110	ALWAYS
Equipment	General Equipment Module	Table 111	ALWAYS
Image	General Image Module	Table 112	ALWAYS
	Image Plane Module	Table 113	ALWAYS
	Image Pixel Module	Table 114	ALWAYS
	PET/NM Orientation Module	Table 115	ALWAYS
	PET Image Module	Table 116	ALWAYS
	VOI LUT Module	Table 117	ALWAYS

IE	Module	Reference	Presence of Module
	SOP Common Module	Table 118	ALWAYS
Private	Private Application	Table 134	ALWAYS
Extensions	Standard Extended Attributes	Table 158	ALWAYS

The following tables describe attribute interpretations for PET images including MU maps. MU maps are encoded in PET IOD. It is not intended to be a substitute for DICOM Standard documentation.

8.1.1.4.1 Module Patient (PET Image)

Table 103 lists all attributes that are supported in the Patient Module for the PET Image IOD.

Table 103: Patient Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Patient's Name	(0010,0010)	PN	MWL/USER	Input from MWL or entered during patient registration or examination setup.	ALWAYS	
Patient ID	(0010,0020)	LO	MWL/USER	Input from MWL or entered or generated during patient registration or examination setup.	ALWAYS	
Patient's Birth Date	(0010,0030)	LO	MWL/USER	Input from MWL or entered during patient registration or examination setup. May be calculated from age.	ALWAYS	
Patient's Sex	(0010,0040)	CS	MWL/USER	Input from MWL or entered during patient registration or examination setup.	ALWAYS	
Patient's Age	(0010,1010)	AS	MWL/USER/AUTO	Input from MWL or entered during patient registration or examination setup. May be calculated from Patient's Birth Date	ALWAYS	
Patient's Weight	(0010,1030)	DS	MWL/USER	Input from MWL or entered during patient registration or examination setup.	ALWAYS	Set to 0 for emergency patients.

8.1.1.4.2 Module General Study (PET Image)

Table 104 lists all attributes that are supported in the General Study Module for the PET Image IOD.

Table 104: General Study Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Study Date	(0008,0020)	DA	MWL/AUTO	For existing studies their date and time entries are copied into the corresponding entries in a new	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				image's header. If a new study is created the date and time entries from the first series of this new study will be used.		
Study Time	(0008,0030)	TM	MWL/AUTO	See above	ALWAYS	
Accession Number	(0008,0050)	SH	MWL/USER	Input entered from MWL or during patient registration. May be zero-length.	VNAP	
Referring Physician's Name	(0008,0090)	PN	MWL/USER	Input from MWL or entered during patient registration or examination setup. May be zero-length.	VNAP	
Study Description	(0008,1030)	LO	MWL/USER	Is derived from information entered during patient registration or examination setup. Concatenated from Body Region and selected Scan Protocol name, separated by a "^".	ALWAYS	
Study Instance UID	(0020,000D)	UI	MWL/AUTO	From MWL or created	ALWAYS	
Study ID	(0020,0010)	UI	MWL/AUTO	From MWL or created	ALWAYS	

8.1.1.4.3 Module Patient Study (PET Image)

Table 105 lists all attributes that are supported in the Patient Study Module for the PET Image IOD.

Table 105: Patient Study Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Admitting Diagnoses Description	(0008,1080)	LO	MWL/USER	Input entered from MWL or during patient registration.	VNAP	

8.1.1.4.4 Module General Series (PET Image)

Table 106 lists all attributes that are supported in the General Series Module for the PET Image IOD.

Table 106: General Series Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Modality	(0008,0060)	CS	AUTO	Value: PT	ALWAYS	
Performing Physician's Name	(0008,1050)	PN	MWL/USER	Input entered from MWL or during patient registration.	VNAP	
Operator's Name	(0008,1070)	PN	USER	According to user input.	VNAP	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Series Description	(0008,103E)	LO	USER/CONFIG	Based on user input and configured suffix.	ALWAYS	Limited to 64 characters
Related Series Sequence	(0008,1250)	SQ	AUTO	Reference to CT series used for attenuation correction Not filled for mu maps	ANAP	
>Study Instance UID	(0020,000D)	UI	AUTO	Instance UID of study to which the related CT series belongs	ANAP	
>Series Instance UID	(0020,000E)	UI	AUTO	Instance UID of related CT series	ANAP	
>Purpose of Reference Code Sequence	(0040,A170)	SQ	AUTO	Describes the purpose for which the reference is made. Zero or more items may be present. When absent, implies that the reason for the reference is unknown. See 8.3.1.1 for supported purposes.	ANAP	
Body Part Examined	(0018,0015)	CS	USER	The Body Part Examined is directly entered by the operator.	ALWAYS	
Protocol Name	(0018,1030)	LO	AUTO	Name of Scan Protocol selected during patient registration or examination setup	ALWAYS	
Patient Position	(0018,5100)	CS	USER	As entered for scan. This value is set despite the use of the Patient Orientation Code Sequence (0054, 0410).	ALWAYS	
Series Instance UID	(0020,000E)	UI	MWL/AUTO	From MWL or created	ALWAYS	
Series Number	(0020,0011)	IS	AUTO	Created	ALWAYS	

8.1.1.4.5 Module PET Series (PET Image)

Table 107 lists all attributes that are supported in the PET Series Module for the PET Image IOD.

Table 107: PET Series Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Series Date	(0008,0021)	DA	AUTO	The DATE to which images in this Series were decay corrected.	ALWAYS	
Series Time	(0008,0031)	TM	AUTO	The TIME to which images in this Series were decay corrected.	ALWAYS	
Collimator Type	(0018,1181)	CS	AUTO	Value: NONE	ALWAYS	
Convolution Kernel	(0018,1210)	SH	AUTO	Filter type and parameters: XYZ Gauss<w>	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				XYZ Hamm<w> XYZ Hann<w> XYZ Parz<w> XYZ BUTW<w>-<o> XYZ SHEP<w> XYZ BOX where <w> is the filter width (fwhm), and <o> is the filter order, e.g. XYZ BUTW5.00-1		
Corrected Image	(0028,0051)	SH	AUTO	Terms used: DECY, ATTN, SCAT, DTIM, RAN, NORM, RADL, PGC and RESPMOT for OncoFreeze Images CARDIOMOT for CardioFreezeSingle Images CARDIOMOT\RESPMOT for CardioFreezeDual Images Blank for mu maps	VNAP	
Energy Window Range Sequence	(0054,0013)	SQ	AUTO	Sequence containing one item describing the energy window used to acquire the PET image series.	ALWAYS	
>Energy Window Lower Limit	(0054,0014)	DS	AUTO	The lower limit of the energy window in keV.	ALWAYS	
>Energy Window Upper Limit	(0054,0015)	DS	AUTO	The upper limit of the energy window in keV.	ALWAYS	
Number of R-R Intervals	(0054,0061)	US	AUTO	Value: 1	ANAP	For gated only
Number of Time Slots	(0054,0071)	US	AUTO	Number of gates (for gated)	ANAP	For gated only
Number of Slices	(0054,0081)	US	AUTO	If PET slice location is configured to match CT slice location, this number is determined by the available number of CT slices within the PET scan range. Otherwise, it is calculated based on bed positions or number of gates/frames, number of detector rings and overlap.	ALWAYS	
Number of Time Slices	(0054,0101)	US	AUTO	Number of frames (for dynamic)	ANAP	For dynamic only
Series Type	(0054,1000)	CS	AUTO	Value 1: WHOLE BODY, DYNAMIC or GATED Value 2: IMAGE	ALWAYS	
Units	(0054,1001)	CS	AUTO	BQML for quantitative, attenuation corrected images PROPCPS for non-quantitative, non attenuation corrected images 1CM for mu maps PCT for PET Patlak Intercept Image MGMINML or	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				UMOLMINML or MLMINML for PET Patlak Slope Image		
Counts Source	(0054,1002)	CS	AUTO	The primary source of counts. EMISSION for PET images TRANSMISSION for mu maps	ALWAYS	
Randoms Correction Method	(0054,1100)	CS	AUTO	Value: DLYD	ALWAYS	
Attenuation Correction Method	(0054,1101)	LO	AUTO	Value for attenuation corrected PET images: measured, name of used CT Series, calculated, CBAC (=Calculated Brain AC) Value for mu maps: measured, calculated	ANAP	
Decay Correction	(0054,1102)	CS	AUTO	The real-world event to which images in this Series were decay corrected. Value: START or ADMIN. START= acquisition start time ADMIN = radiopharmaceutical administration time This refers to the Series Date and Time, see (0008,0021) and (0008,0031) and private attribute (0071,1022) NONE for mu maps	ALWAYS	
Reconstruction Method	(0054,1103)	LO	AUTO	Values: Backprojection Backprojection+TOF OSEM2D <m>i<n>s OSEM3D <m>i<n>s OSEM3D+TOF <m>i<n>s PSF <m>i<n>s PSF+TOF <m>i<n>s Patlak WB OSEM2D <m>i<n>s WB OSEM3D <m>i<n>s WB OSEM3D+TOF <m>i<n>s WB PSF <m>i<n>s WB PSF+TOF <m>i<n>s where <m> is the number of iterations and <n> the number of subsets, e.g. OSEM3D 2i8s. WB prefix is added in case WB scatter scaling is used.	ALWAYS	
Scatter Correction Method	(0054,1105)	LO	AUTO	Set if Scatter correction was applied. Values: Model-based, relative scatter scaling Model-based, absolute scatter scaling Model-based, WB relative scatter scaling	ANAP	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				Model-based, WB absolute scatter scaling		
Axial Acceptance	(0054,1200)	DS	AUTO	The maximum detector ring difference instead of angle in degrees.	ALWAYS	
Axial Mash	(0054,1201)	IS	AUTO	Number of adjacent axial lines of response mashed together	ALWAYS	

8.1.1.4.6 Module PET Isotope (PET Image)

Table 108 lists all attributes that are supported in the PET Isotope Module for the PET Image IOD.

Table 108: PET Isotope Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Radiopharmaceutical Information Sequence	(0054,0016)	SQ	AUTO	Sequence containing items describing the isotope information. Blank for mu maps	VNAP	
>Radiopharmaceutical Volume	(0018,1071)	DS	AUTO	Volume of administered radiopharmaceutical in cubic cm.	VNAP	
>Radiopharmaceutical Start Time	(0018,1072)	TM	AUTO	Time of start of injection (Since there is no attribute for the injection date, a day shift between start of injection and start of acquisition is encoded in the last 3 digits of the injection time.)	VNAP	
>Radionuclide Total Dose	(0018,1074)	DS	AUTO	The radiopharmaceutical dose administered to the patient measured in Becquerel (Bq) at the Radiopharmaceutical Start Time	VNAP	
>Radiopharmaceutical Administration Event UID	(0008,3012)	UI	AUTO	Unique identification of the administration of the radiopharmaceutical to the patient. Note: The UID is the same Radiopharmaceutical Administration Event UID that is in the Radiopharmaceutical Radiation Dose Report.	VNAP	
>Radionuclide Half Life	(0018,1075)	DS	AUTO	The radionuclide half-life, in seconds, that was used in the correction of this image.	VNAP	
>Radionuclide Positron Fraction	(0018,1076)	DS	AUTO	The radionuclide positron fraction (fraction of decays that are by positron emission) that was used in	VNAP	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				the correction of this image, e.g., 0.97 for 18F.		
>Radiopharmaceutical Start DateTime	(0018,1078)	DT	AUTO	Date and time of start of administration. The actual date and time of radiopharmaceutical administration to the patient for imaging purposes, using the same time base as Series Time (0008, 0031).	VNAP	
>Radiopharmaceutical Stop DateTime	(0018,1079)	DT	AUTO	Date and time of end of administration. The actual ending date and time of radiopharmaceutical administration to the patient for imaging purposes, using the same time base as Series Time (0008,0031).	VNAP	
>Radionuclide Code Sequence	(0054,0300)	SQ	AUTO	Sequence that identifies the radionuclide. Only present for radionuclides defined in Table 138	VNAP	
>>Code Value	(0008,0100)	SH	AUTO	See Table 138	VNAP	
>>Coding Scheme Designator	(0008,0102)	SH	AUTO	See Table 138	VNAP	
>>Code Meaning	(0008,0104)	LO	AUTO	See Table 138	VNAP	
>Radiopharmaceutical	(0018,0031)	LO	AUTO	Name of the radiopharmaceutical	VNAP	
>Radiopharmaceutical Code Sequence	(0054,0304)	SQ	AUTO	Sequence that identifies the radiopharmaceutical. Only present for radiopharmaceuticals defined in Table 139	VNAP	
>>Code Value	(0008,0100)	SH	AUTO	See Table 139	VNAP	
>>Coding Scheme Designator	(0008,0102)	SH	AUTO	See Table 139	VNAP	
>>Code Meaning	(0008,0104)	LO	AUTO	See Table 139	VNAP	

8.1.1.4.7 Module PET Multi-gated Acquisition Module (PET Image)

Table 109 lists all attributes that are supported in the PET Multi-gated Acquisition Module for the PET Image IOD.

Table 109: PET Multi-gated Acquisition Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Cardiac Framing Type	(0018,1064)	LO	AUTO	Value: PHASED Gated Only.	ANAP	
Beat Rejection Flag	(0018,1080)	CS	AUTO	Value: Y for trigger gating, N for respiratory waveform gating Gated only.	ANAP	

Skip Beats	(0018,1086)	IS	AUTO	Number of skipped beats after a detected arrhythmia. Gated only.	ANAP	
Heart Rate	(0018,1088)	IS	AUTO	Average number of heart beats or respirations per minute for the collection period. This includes all accepted and rejected beats or respirations. Gated only.	ANAP	

8.1.1.4.8 Module Frame of Reference (PET Image)

Table 110 lists all attributes that are supported in the Frame of Reference Module for the PET Image IOD.

Table 110: Frame of Reference Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Frame of Reference UID	(0020,0052)	UI	AUTO	Created	ALWAYS	
Position Reference Indicator	(0020,1040)	LO	AUTO	Null	EMPTY	

8.1.1.4.9 Module General Equipment (PET Image)

Table 111 lists all attributes that are supported in the General Equipment Module for the PET Image IOD.

Table 111: General Equipment Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Manufacturer	(0008,0070)	LO	AUTO	Value: SIEMENS	ALWAYS	
Institution Name	(0008,0080)	LO	CONFIG/USER	Hospital name read from configuration data or user input entered during patient registration or examination setup.	ALWAYS	
Institution Address	(0008,0081)	ST	CONFIG	Hospital address read from configuration data. Default format is 4 lines containing Street, City, District and Country.	ALWAYS	
Station Name	(0008,1010)	SH	CONFIG	Station name as per site specific configuration.	ALWAYS	
Institutional Department Name	(0008,1040)	LO	CONFIG	According to site configuration.	ALWAYS	
Manufacturer's Model Name	(0008,1090)	LO	AUTO	One of the following based on system type: "Biograph20_mCT 3R" "Biograph20_mCT 4R" "Biograph40_mCT 3R" "Biograph40_mCT 4R"	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				"Biograph64_mCT 3R" "Biograph64_mCT 4R" "Biograph128_mCT 3R" "Biograph128_mCT 4R" "Biograph128_mCT 3R Edge" "Biograph128_mCT 4R Edge"		
Device Serial Number	(0018,1000)	LO	AUTO	Serial number of the PET/CT system	ALWAYS	
Software Version(s)	(0018,1020)	LO	AUTO	Biograph mCT software version. One or two values. If two values are present, the first value indicates the SW version in which the data were acquired; the second is the SW version in which the data have been reconstructed.	ALWAYS	
Date of Last Calibration	(0018,1200)	DA	AUTO	Date of last Gantry Calibration / FOV Offset	ALWAYS	
Time of Last Calibration	(0018,1201)	TM	AUTO	Time of last Gantry Calibration / FOV Offset	ALWAYS	

8.1.1.4.10 Module General Image (PET Image)

Table 112 lists all attributes that are supported in the General Image Module for the PET Image IOD.

Table 112: General Image Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Image (Content) Date	(0008,0023)	DA	AUTO	Image (Content) Date for PET images is set to the real-world date when the images are generated.	ALWAYS	
Image (Content) Time	(0008,0033)	TM	AUTO	Image (Content) Time for PET images is set to the real-world time when the images are generated.	ALWAYS	
Acquisition Number	(0020,0012)	IS	AUTO	A combination of the scan range number within the examination and bed index. For example, for standard whole-body scans (Topo, Spiral CT range, PET range) , the acquisition number is set to 2 * 1000 + bed index	ALWAYS	

Image Comments	(0020,4000)	LT	AUTO/USER/CONFIG	Concatenated string, separated by "^": - User input for comment - Blood Glucose information <BGL:value:units> - Gate definition for gated images - Frame description for dynamic images - Pass information for Summed WB Dynamic - CT series description for attenuation correction - /TF if transformation matrix was applied - /MAR if metal artefact correction was applied - Volume Scaling if Volume Scaling was applied - /Mu for mu maps	VNAP	

8.1.1.4.11 Module Image Plane (PET Image)

Table 113 lists all attributes that are supported in the Image Plane Module for the PET Image IOD.

Table 113: Image Plane Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Slice Thickness	(0018,0050)	DS	AUTO	Resulting slice thickness. It should be the same as the CT slice thickness if the PET reconstruction is configured to create PET image that matches CT slice location.	ALWAYS	
Image Position (Patient)	(0020,0032)	DS	AUTO	The x, y, z coordinates of the center of the first pixel in mm in the CT coordinate system. The coordinates are generated after the PET/CT FOV offset correction and hence may be used directly by PET/ CT image fusion applications.	ALWAYS	
Image Orientation (Patient)	(0020,0037)	DS	AUTO	Direction cosines of the first row and first column with respect to the patient.	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Slice Location	(0020,1041)	DS	AUTO	Relative position of the intersection of the image slice with the z-axis in mm. This position is relative to the current reference point and corresponds to the table position. It is generated after the PET/CT FOV z-offset correction.	ALWAYS	
Pixel Spacing	(0028,0030)	DS	AUTO	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm.	ALWAYS	

8.1.1.4.12 Module Image Pixel (PET Image)

Table 114 lists all attributes that are supported in the Image Pixel Module for the PET Image IOD.

Table 114: Image Pixel Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Rows	(0028,0010)	US	AUTO	Number of rows in the image	ALWAYS	
Columns	(0028,0011)	US	AUTO	Number of columns in the image	ALWAYS	
Pixel Representation	(0028,0103)	US	AUTO	Value: 0 (unsigned) or 1 (signed) depending on minimum pixel value	ALWAYS	
Smallest Image Pixel Value	(0028,0106)	US	AUTO	Calculated during image reconstruction.	ALWAYS	
Largest Image Pixel Value	(0028,0107)	US	AUTO	Calculated during image reconstruction.	ALWAYS	
Pixel Data	(7FE0,0010)	OW	AUTO		ALWAYS	

8.1.1.4.13 Module NM/PET Patient Orientation (PET Image)

Table 115 lists all attributes that are supported in the NM/PET Patient Orientation Module for the PET Image IOD.

Table 115: NM/PET Patient Orientation Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Patient Orientation Code Sequence	(0054,0410)	SQ	AUTO	Sequence containing one item that describes the orientation of the patient with respect to gravity. Values: recumbent	ALWAYS	
>Patient Orientation Modifier Code Sequence	(0054,0412)	SQ	USER	Sequence containing one item that modifies or enhances the orientation	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				specified by Patient Orientation Code Sequence. Values: supine, prone, right lateral decubitus, left lateral decubitus		
Patient Gantry Relationship Code Sequence	(0054,0414)	SQ	USER	Sequence containing one item that describes the orientation of the patient with respect to the gantry. Values: head-first or feet-first.	ALWAYS	

8.1.1.4.14 Module PET Image(PET Image)

Table 116 lists all attributes that are supported in the PET Image Module for the PET Image IOD.

Table 116: PET Image Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Image Type	(0008,0008)	CS	AUTO	For PET images: Value 1: ORIGINAL Value 2: PRIMARY Value 3: STRESS or REST for Cardiac images For PET topogram image: Value 1: ORIGINAL Value 2: PRIMARY Value 3: LOCALIZER Value 4: PET_TOPO For mu maps: Value 1: DERIVED Value 2: PRIMARY Value 3: AC_MAP For statistics image: Value 1: DERIVED Value 2: SECONDARY Value 3: OTHER For PET Patlak Slope Image: Value 1: ORIGINAL Value 2: PRIMARY Value 3: PATLAK SLOPE For PET Patlak Intercept Image: Value 1: ORIGINAL Value 2: PRIMARY Value 3: PATLAK INTERCEPT	ALWAYS	
Acquisition Date	(0008,0022)	DA	AUTO	Acquisition Date and Time is defined as the real- world beginning of the accumulation of data which contribute to a particular image. Whole Body PET images belonging to the same bed position share the same acquisition date and	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
				time. In case of dynamic studies the acquisition time is different for different frames at the same bed position.		
Acquisition Time	(0008,0032)	TM	AUTO	See above	ALWAYS	
Trigger Time	(0018,1060)	DS	AUTO	For trigger gating: time interval in ms from start of trigger to the beginning of data acquisition for this image. For respiratory waveform gating: time offset of the start of the gate from the previous Inspiration Peak. These values are normalized across all the respiratory cycles.	ANAP	For gated only
Nominal Interval	(0018,1062)	IS	AUTO	Average duration of accepted beats or respirations Gated only.	ANAP	For gated only
Frame Time	(0018,1063)	DS	AUTO	Nominal duration per individual frame in ms. Gated only.	ANAP	For gated only
Low R-R Value	(0018,1081)	IS	AUTO	For trigger gating: R-R interval lower limit for beat rejection. For respiratory waveform gating: lowest time interval between respiratory peaks Gated only.	ANAP	For gated only
High R-R Value	(0018,1082)	IS	AUTO	For trigger gating: R-R interval upper limit for beat rejection. For respiratory waveform gating: lowest time interval between respiratory peaks Gated only.	ANAP	For gated only
Intervals Acquired	(0018,1083)	IS	AUTO	Total number of accepted beats or respiratory cycles Gated only.	ANAP	For gated only
Intervals Rejected	(0018,1084)	IS	AUTO	Total number of rejected beats. Gated only.	ANAP	For gated only
Actual Frame Duration	(0018,1242)	IS	AUTO	Actual time elapsed during acquisition	ALWAYS	
Samples per Pixel	(0028,0002)	US	AUTO	Value: 1	ALWAYS	
Photometric Interpretation	(0028,0004)	CS	AUTO	Value: MONOCHROME2	ALWAYS	
Bits Allocated	(0028,0100)	US	AUTO	Value: 16	ALWAYS	
Bits Stored	(0028,0101)	US	AUTO	Value: 16	ALWAYS	
High Bit	(0028,0102)	US	AUTO	Value: 15	ALWAYS	

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Rescale Intercept	(0028,1052)	DS	AUTO	Value: 0	ALWAYS	
Rescale Slope	(0028,1053)	DS	AUTO	Calculated during image reconstruction. Identical for all images in a frame if Volume Scaling is selected.	ALWAYS	
Frame Reference Time	(0054,1300)	DS	AUTO	Time offset from the series time in ms. This value is different for images acquired in different bed positions or dynamic frames, but is the same for all gates.	ALWAYS	
Decay Factor	(0054,1321)	DS	AUTO	The decay factor that was used to scale this image. The measured activity is corrected back to the reference time (0054,1102) with the following factor: $e^{\lambda(t_{start}-t_{reference})}\frac{\lambda T_{frame}}{1-e^{-\lambda T_{frame}}}$ with $\lambda = \frac{ln\,2}{T_{1/2}}$ where t_{start} is the frame start time, $t_{reference}$ the reference time, T_{frame} the frame duration, and $T_{1/2}$ the half life time of the radionuclide, see (0018,1075)	ALWAYS	
Dose Calibration Factor	(0054,1322)	DS	AUTO	A factor that was used to scale this image from ECAT counts/sec to Bq/ml using a dose calibrator. The value is 1 if normalization was not applied.	ALWAYS	
Scatter Fraction Factor	(0054,1323)	DS	AUTO	An estimate of the fraction of acquired counts that were due to scatter and were corrected in this image. The value shall be 0 if no scatter correction was applied.	VNAP	
Image Index	(0054,1330)	US	AUTO	An encoded index identifying the position of the image within the PET series which is viewed as a multi-dimensional array. Used for sorting of PET images (whole body, dynamic, gated)	ALWAYS	
(Private data)	(0071,xxxx)			See Section 8.2.2		

8.1.1.4.15 Module VOI LUT (PET Image)

Table 117 lists all attributes that are supported in the VOI LUT Module for the PET Image IOD.

Table 117: VOI LUT Module

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Window Center	(0028,1050)	DS	AUTO	Calculated during image reconstruction.	ALWAYS	
Window Width	(0028,1051)	DS	AUTO	Calculated during image reconstruction.	ALWAYS	

8.1.1.4.16 Module SOP Common (PET Image)

Table 118 lists all attributes that are supported in the SOP Common Module for the PET Image IOD.

Table 118: SOP Common

Attribute Name	Tag	VR	Source	Value	Presence	Comment
SOP Class UID	(0008,0016)	UI	AUTO	Value: 1.2.840.10008.5.1.4.1.1.128	ALWAYS	
SOP Instance UID	(0008,0018)	UI	AUTO	As specified in DICOM standard Part 5 section 9 Unique Identifiers (UIDs)	ALWAYS	
Instance Number	(0020,0013)	IS	AUTO	Created. The order of the Instance Number is not selectable by the user. The images will be numbered in the ascending order in the direction how they are acquired.	ALWAYS	

8.1.1.5 Radiation Dose SR IOD

Biograph mCT creates Radiopharmaceutical Radiation Dose Reports for PET examinations and CT Radiation Dose SRs for the CT examinations performed on the system.

The following table specifies the Modules supported in Radiation Dose SR IODs.

Table 119: Radiation Dose SR IOD Modules

IE	Module	Reference	Presence of Module
Patient	Patient	Table 103	ALWAYS
Study	General Study	Table 104	ALWAYS
	Patient Study	Table 75	If Type 3 attributes are used
Series	SR Document Series	Table 120	ALWAYS
Equipment	General Equipment	Table 111	ALWAYS
	Enhanced General Equipment	Table 121	ALWAYS
Document	SR Document General	Table 122	ALWAYS
	SR Document Content	Table 123	ALWAYS
	SOP Common	Table 124	ALWAYS
Private	Private Application	Table 135	ALWAYS

The following tables describe the content of the SR specific modules listed in Table 119: Radiation Dose SR IOD Modules

8.1.1.5.1 Module SR Document Series (Radiation Dose SR)

Table 120 lists all attributes that are supported in the SR Document Series Module for the Radiation Dose SR.

Table 120: SR Document Series Module of created Radiation Dose SR Instances

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Series Date	(0008,0021)	DA	AUTO	Generated by System	ALWAYS	
Series Time	(0008,0031)	TM	AUTO	Generated by System	ALWAYS	
Modality	(0008,0060)	CS	AUTO	SR	ALWAYS	
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	MWL/AUTO	Empty	VNAP	
Series Description	(0008,1030)	LS	AUTO	PET Dose Report SR for Radiopharmaceutical Radiation Dose SR and Dose SR for CT Radiation Dose SR	ALWAYS	
Series Instance UID	(0020,000E)	UI	AUTO	Generated by System	ALWAYS	
Series Number	(0020,0011)	IS	AUTO	Generated by System	ALWAYS	

8.1.1.5.2 Module: Enhanced General Equipment Series (Radiation Dose SR)

Table 121 lists all attributes that are supported in the Enhanced General Equipment Module for the Radiation Dose SR.

Table 121: Enhanced General Equipment Module of Create Radiation Dose SR Instances

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Manufacturer	(0008,0070)	LS	AUTO	"SIEMENS" [21]	ALWAYS	
Manufacturer's Model Name	(0008,1090)		AUTO	One of the following based on system type: "Biograph20_mCT 3R" "Biograph20_mCT 4R" "Biograph40_mCT 3R" "Biograph40_mCT 4R" "Biograph64_mCT 3R" "Biograph64_mCT 4R" "Biograph128_mCT 3R" "Biograph128_mCT 4R" "Biograph128_mCT 3R Edge" "Biograph128_mCT 4R Edge"		
Device Serial Number	(0018,1000)	LS	CONFIG		ALWAYS	
Software Versions	(0018,1020)	LS	AUTO	"VG80A"		

[21] Will be replaced by "Siemens Healthineers" in future versions

8.1.1.5.3 Module SR Document General (Radiation Dose SR)

Table 122 lists all attributes that are supported in the SR Document General Module for the Radiation Dose SR.

Table 122: SR Document General Module of created Radiation Dose SR Instances

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Instance Number	(0020,0013)	IS	AUTO	Generated by System	ALWAYS	
Content Date	(0008,0023)	DA	AUTO	Image (Content) Date for Radiation Dose SR is set to the real-world date when the dose report is generated.	ALWAYS	
Content Time	(0008,0033)	TM	AUTO	Image (Content) Time for Radiation Dose SR is set to the real-world time when the dose report is generated.	ALWAYS	
Completion Flag	(0040,A491)	CS	AUTO	COMPLETE	ALWAYS	
Verification Flag	(0040,A493)	CS	AUTO	UNVERIFIED	ALWAYS	

8.1.1.5.4 Module SR Document Content Series (Radiation Dose SR)

Table 123 lists all attributes that are supported in the SR Document Content Module for the Radiation Dose SR.

Table 123: SR Document Content Module of created Radiation Dose SR Instances

Attribute Name	Tag	VR	Source	Value	Presence	Comment
Value Type	(0040,A040)	CS	AUTO	CONTAINER	ALWAYS	
Continuity of Content	(0040,A050)	CS	AUTO	SEPARATE	ALWAYS	
Content Template Sequence	(0040,A504)	SQ	AUTO		ALWAYS	
>Mapping Resource	(0008,0105)	CS	AUTO	DCMR	ALWAYS	
>Template Identifier	(0040,DB00)	CS	AUTO	TID 10011 for the CT Radiation Dose SR TID 10021 for the Radiopharmaceutical Radiation Dose SR	ALWAYS	
Content Sequence	(0040,A730	SQ	AUTO	Refer to Section 8.3.2.1 for the content of the Radiopharmaceutical Radiation Dose SR and Refer to Section 8.3.2.2 for the CT Radiation Dose SR	ALWAYS	

8.1.1.5.5 Module SOP Common (Radiation Dose SR)

Table 124 lists all attributes that are supported in the SOP Common Module for the Radiation Dose SR.

Table 124: SOP Common Module of created Radiation Dose SR Instances

Attribute Name	Tag	VR	Source	Value	Presence	Comment
SOP Class UID	(0008,0016)	UI	AUTO	1.2.840.10008.5.1.4.1.1.88.67 For the CT Radiation Dose SR 1.2.840.10008.5.1.4.1.1.88.68 For the Radiopharmaceutical Radiation Dose SR	ALWAYS	
SOP Instance UID	(0008,0018)	UI	AUTO	Generated by System	ALWAYS	
Specific Character Set	(0008,0005)	CS	AUTO	ISO_IR 100	ALWAYS	

8.1.1.6 Instance created by the Merge Multi CT Tool

The following section describes attribute interpretations for CT images generated by Merge Multi CT tool.

Multiple CT series are merged into one (Result Series) that is used for attenuation correction during creation of PET images.

The series level attributes are copied from the original CT series that contains the image with the lowest (most negative) Slice Location (0020, 1041) value.

The image level attributes are copied from the source CT image.

Following attributes are updated, changed or removed relative to the original CT image:

Table 125: Instance created by the Merge Multi CT Tool

Name	Tag	Explanation
Series Description	(0008, 103E)	Supplied by user
Body Part Examined	(0018, 0015)	Removed
Series Number	(0020, 0011)	Set in range 0-500, the lowest unused number
Image Type	(0008, 0008)	Value 1 set to DERIVED
Image Date (Content Date)	(0008, 0023)	Current date when result image is created
Image Time (Content Time)	(0008, 0033	Current time when result image is created
Image Number (Instance Number)	(0020, 0013)	Craniocaudal: Image order increases with increase of Z-position of image slice. Caudocranial: Image order decreases with increase of Z-position of image slice
Source Image Sequence	(0008, 2112)	SOP - 1.2.840.10008.5.1.4.1.1.2 SOP Instance - UID of the CT series (original one) that slice is generated from
Reference Image Sequence	(0008, 1140)	Removed if set
Derivation Description	(0008, 2111)	Set to: MULTI CT FOR AC

Image Comment	(0020, 4000)	Image comment from the original image (1st slice), appended series description from the original CT series that slice is generated from. ^ is used as delimiter
Largest Image Pixel Value	(0028, 0107)	Removed if set
Smallest Image Pixel Value	(0028, 0106)	Removed if set
Slice Thickness	(0018, 0050)	Supplied by user
Image Position Patient	(0020, 0032)	Replaced the 3rd value in the array, a new calculated z-position
KVP	(0018,0060)	Read from the source CT image.
Scan Options	(0018,0022)	Removed if set
Data Collection Diameter	(0018,0090)	Removed if set
Data Collection Center	(0018,9313)	Removed if set
Reconstruction Diameter	(0018,1100)	Read from the source CT image.
Reconstruction Target Center (Patient)	(0018,9318)	Removed if set
Distance Source to Detector	(0018,1110)	Removed if set
Distance Source to Patient	(0018,1111)	Removed if set
Gantry/Detector Tilt	(0018,1120)	Removed if set
Table Height	(0018,1130)	Read from the source CT image.
Rotation Direction	(0018,1140)	Removed if set
Exposure Time	(0018,1150)	Removed if set
X-Ray Tube Current	(0018,1151)	Removed if set
Exposure	(0018,1152)	Removed if set
Exposure in uAs	(0018,1153)	Removed if set
Filter Type	(0018,1160)	Removed if set
Generator Power	(0018,1170)	Removed if set
Focal Spots	(0018,1190)	Removed if set
Convolution Kernel	(0018,1210)	Removed if set
Revolution Time	(0018,9305)	Removed if set
Single Collimation Width	(0018,9306)	Removed if set
Total Collimation Width	(0018,9307)	Removed if set
Table Speed	(0018,9309)	Removed if set
Table Feed per Rotation	(0018,9310)	Removed if set
Spiral Pitch Factor	(0018,9311)	Removed if set
Exposure Modulation Type	(0018,9323)	Removed if set
Estimated Dose Saving	(0018,9324)	Removed if set
CTDIvol	(0018,9345)	Removed if set

CTDI Phantom Type Code Sequence	(0018,9346)	Removed if set
Calcium Scoring Mass Factor Patient	(0018,9351)	Removed if set
Calcium Scoring Mass Factor Device	(0018,9352)	Removed if set
Energy Weighting Factor	(0018,9353)	Removed if set
CT Additional X-Ray Source Sequence	(0018,9360)	Removed if set
Isocenter Position	(300A,012C)	Removed if set

8.1.2 Usage of Attributes from Received IODs

See the following sections for attributes used in MPPS and IODs created by Biograph mCT.

2.2.7.3.1.2 Patient Registration SOP specific Conformance for SOP classes

2.2.7.3.2.2 Update SOP specific Conformance for SOP classes

8.1.1 Created SOP Instances

8.1.3 Attribute Mapping

See the following sections for attributes used in MPPS and IODs created by Biograph mCT.

2.2.7.3.1.2 Patient Registration SOP specific Conformance for SOP classes

2.2.7.3.2.2 Update SOP specific Conformance for SOP classes

8.1.1 Created SOP Instances

8.1.4 Coerced/Modified Fields

N/A

8.2 Data Dictionary of Private Attributes

8.2.1 Private Elements for all Storage SOP Classes

The following table provides an overview of all private attributes supported in syngo based applications.

Table 126: Registry of DICOM Data Elements

Tag	Private Owner Code	Name	VR	VM
(0029,xx08)	SIEMENS CSA HEADER	CSA Image Header Type	CS	1
(0029,xx09)	SIEMENS CSA HEADER	CSA Image Header Version	LO	1
(0029,xx10)	SIEMENS CSA HEADER	CSA Image Header Info	OB	1
(0029,xx18)	SIEMENS CSA HEADER	CSA Series Header Type	CS	1
(0029,xx19)	SIEMENS CSA HEADER	CSA Series Header Version	LO	1
(0029,xx20)	SIEMENS CSA HEADER	CSA Series Header Info	OB	1
(0029,xx08)	SIEMENS CSA NON-IMAGE	CSA Data Type	CS	1
(0029,xx09)	SIEMENS CSA NON-IMAGE	CSA Data Version	LO	1

(0029,xx10)	SIEMENS CSA NON-IMAGE	CSA Data Info	OB	1
(0029,xx08)	SIEMENS CSA REPORT	*syngo* Report Type	CS	1
(0029,xx09)	SIEMENS CSA REPORT	*syngo* Report	LO	1
(0029,xx15)	SIEMENS CSA REPORT	SR Variant	US	1
(0029,xx17)	SIEMENS CSA REPORT	SC SOP Instance UID	UI	1
(0029,xx10)	SIEMENS CSA ENVELOPE	syngo Report Data	OB	1
(0029,xx11)	SIEMENS CSA ENVELOPE	syngo Report Presentation	OB	1
(0029,xx08)	SIEMENS MEDCOM HEADER	MedCom Header Type	CS	1
(0029,xx09)	SIEMENS MEDCOM HEADER	MedCom Header Version	LO	1
(0029,xx10)	SIEMENS MEDCOM HEADER	MedCom Header Info	OB	1
(0029,xx20)	SIEMENS MEDCOM HEADER	MedCom History Information	OB	1
(0029,xx31)	SIEMENS MEDCOM HEADER	PMTF Information 1	LO	1
(0029,xx32)	SIEMENS MEDCOM HEADER	PMTF Information 2	UL	1
(0029,xx33)	SIEMENS MEDCOM HEADER	PMTF Information 3	UL	1
(0029,xx34)	SIEMENS MEDCOM HEADER	PMTF Information 4	CS	1
(0029,xx35)	SIEMENS MEDCOM HEADER	PMTF Information 5	UL	1
(0029,xx40)	SIEMENS MEDCOM HEADER	Application Header Sequence	SQ	1
(0029,xx41)	SIEMENS MEDCOM HEADER	Application Header Type	CS	1
(0029,xx42)	SIEMENS MEDCOM HEADER	Application Header ID	LO	1
(0029,xx43)	SIEMENS MEDCOM HEADER	Application Header Version	LO	1
(0029,xx44)	SIEMENS MEDCOM HEADER	Application Header Info	OB	1
(0029,xx50)	SIEMENS MEDCOM HEADER	Workflow Control Flags	LO	8
(0029,xx51)	SIEMENS MEDCOM HEADER	Archive Management Flag Keep Online	CS	1
(0029,xx52)	SIEMENS MEDCOM HEAD	Archive Management Flag Do Not Archive	CS	1
(0029,xx53)	SIEMENS MEDCOM HEADER	Image Location Status	CS	1
(0029,xx54)	SIEMENS MEDCOM HEADER	Estimated Retrieve Time	DS	1
(0029,xx55)	SIEMENS MEDCOM HEADER	Data Size of Retrieved Images	DS	1
(0029,xx70)	SIEMENS MEDCOM HEADER	Siemens Link Sequence	SQ	1
(0029,xx71)	SIEMENS MEDCOM HEADER	Referenced Tag	AT	1
(0029,xx72)	SIEMENS MEDCOM HEADER	Referenced Tag Type	CS	1
(0029,xx73)	SIEMENS MEDCOM HEADER	Referenced Value Length	UL	1
(0029,xx74)	SIEMENS MEDCOM HEADER	Referenced Object Device Type	CS	1
(0029,xx75)	SIEMENS MEDCOM HEADER	Referenced Object Device Location	OB	1
(0029,xx76)	SIEMENS MEDCOM HEADER	Referenced Object ID	OB	1
(0029,xx60)	SIEMENS MEDCOM HEADER2	Series Work Flow Status	LO	1
(0029,xx08)	SIEMENS MEDCOM OOG	MEDCOM OOG Type	CS	1
(0029,xx09)	SIEMENS MEDCOM OOG	MEDCOM OOG Version	LO	1
(0029,xx10)	SIEMENS MEDCOM OOG	MEDCOM OOG Info	OB	1

(7FE1,xx10)	SIEMENS CSA NON-IMAGE	CSA Data	OB	1

8.2.1.1 Extended Image IOD Module Table

The following Table describes the extension with private modules of the Image IODs supported by the Biograph mCT DICOM application

Table 127: Extensions of Image IODs

IE	Module	Reference	Usage	Note
Patient	Patient	See IOD specific subsection in Section 8.1.1	M	
Study	General Study		M	
	Patient Study		U	
Series	General Series		M	
Equipment	General Equipment		U	
Image	General Image		M	
	Image Pixel		M	
	IOD specific modules		M/U	depends on the IOD
	CSA Image Header	Table 128	U	
	CSA Series Header	Table 129	U	
	MEDCOM Header	Table 130	U	private *syngo* information
	MEDCOM OOG	Table 132	U	if object graphics is attached to image
	SOP Common	See IOD specific subsection in Section 8.1.1	M	

8.2.1.1.1 CSA Image Header Module

The table in this section contains private IOD Attributes that describe the CSA Image Header.

Table 128: CSA Image Header Module

Attribute Name	Tag	Private Creator	Type	Notes
CSA Image Header Type	(0029,xx08)	SIEMENS CSA HEADER	1	CSA Image Header identification characteristics. Defined Terms: NUM 4 = NUMARIS/4 SOM 5 = Somaris/5 or Biograph mCT
CSA Image Header Version	(0029,xx09)	SIEMENS CSA HEADER	3	Version of CSA Image Header Info (0029,xx10) format.
CSA Image Header Info	(0029,xx10)	SIEMENS CSA HEADER	3	Manufacturer Model dependent information.

8.2.1.1.2 CSA Series Header Module

The table in this section contains private IOD Attributes that describe the CSA Series Header.

Table 129: CSA Series Header Module

Attribute Name	Tag	Private Creator	Type	Notes
CSA Series Header Type	(0029,xx18)	SIEMENS CSA HEADER	1	CSA Series Header identification characteristics. Defined Terms: NUM 4 = NUMARIS/4 SOM 5 = Somaris/5
CSA Series Header Version	(0029,xx19)	SIEMENS CSA HEADER	3	Version of CSA Series Header Info (0029,xx20) format.
CSA Series Header Info	(0029,xx20)	SIEMENS CSA HEADER	3	Manufacturer Model dependent information.

8.2.1.1.3 MEDCOM Header Module

The table in this section contains private IOD Attributes that describe MEDCOM Header.

Table 130: MEDCOM Header Module

Attribute Name	Tag	Private Creator	Type	Notes
MedCom Header Type	(0029,xx08)	SIEMENS MEDCOM HEADER	1C	MedCom Header identification characteristics. Defined Terms: MEDCOM 1 Required if MedCom Header Info (0029,xx10) present.
MedCom Header Version	(0029,xx09)	SIEMENS MEDCOM HEADER	2C	Version of MedCom Header Info (0029,xx10) format. Required if MEDCOM Header Info (0029,xx10) present.
MedCom Header Info	(0029,xx10)	SIEMENS MEDCOM HEADER	3	Manufacturer model dependent information. The value of the attribute MedCom Header Info (0029,xx10) can be build up in each user defined format.
MedCom History Information	(0029,xx20)	SIEMENS MEDCOM HEADER	3	MedCom defined Patient Registration history information. See 5.2.1.2.4.1.
PMTF Information 1	(0029,xx31)	SIEMENS MEDCOM HEADER	3	Transformation Information

Attribute Name	Tag	Private Creator	Type	Notes
PMTF Information 2	(0029,xx32)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 3	(0029,xx33)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 4	(0029,xx34)	SIEMENS MEDCOM HEADER	3	Transformation Information
Application Header Sequence	(0029,xx40)	SIEMENS MEDCOM HEADER	3	Sequence of Application Header Items. Zero or more Items shall be included in this sequence. Encoded as a sequence of items.
>Application Header Type	(0029,xx41)	SIEMENS MEDCOM HEADER	1C	Application Header identification characteristics. Required if Sequence is sent.
>Application Header ID	(0029,xx42)	SIEMENS MEDCOM HEADER	3	Identification of an application header.
>Application Header Version	(0029,xx43)	SIEMENS MEDCOM HEADER	3	Version of Application Header Info (0029,xx43) format.
>Application Header Info	(0029,xx44)	SIEMENS MEDCOM HEADER	3	Application dependent information.
Workflow Control Flags	(0029,xx50)	SIEMENS MEDCOM HEADER	3	Eight free definable flags.
Archive Management Flag Keep Online	(0029,xx51)	SIEMENS MEDCOM HEADER	3	Flag to control remote archive management system to keep the image always online (also when already archived). Enumerated Values: 00 = remote control not required, 01 = keep image online.
Archive Management Flag Do Not Archive	(0029,xx52)	SIEMENS MEDCOM HEADER	3	Flag to control remote archive management system not to archive the related image. Enumerated Values: 00 = remote control not required, 01 = don't archive image.

Attribute Name	Tag	Private Creator	Type	Notes
Image Location Status	(0029,xx53)	SIEMENS MEDCOM HEADER	3	Image location status to control retrieving. Defined Terms: ONLINE = retrieving has to be done as usual, NEARLINE = move request to SCP and delay according to value of Estimated Retrieve Time (0029,xx54), OFFLINE = invoking a retrieve operation initiates an operator request, INVALID = invoking a retrieve operation would always result in an error.
Estimated Retrieve Time	(0029,xx54)	SIEMENS MEDCOM HEADER	3	Estimated retrieve time in seconds. A value less then zero (< 0) indicates location is OFFLINE or INVALID.
Data Size of Retrieved Images	(0029,xx55)	SIEMENS MEDCOM HEADER	3	Data size of images in MByte.
Siemens Link Sequence	(0029,xx70)	SIEMENS MEDCOM HEADER	3	Sequence of Link items. Each item identifies the location of the location of one missing tag. One or more items can be located in this sequence.
Referenced Tag	(0029,xx71)	SIEMENS MEDCOM HEADER	1	The referenced tag. The value of this tag is in the Child Data Object (CDO). Currently it is always Pixel Data (7FE0,0010).
Referenced Tag Type	(0029,xx72)	SIEMENS MEDCOM HEADER	1	The value representation (type) of the missing tag (e.g. OW). Enumerated values are all DICOM defined Value Representations.
Referenced Value Length	(0029,xx73)	SIEMENS MEDCOM HEADER	1	The length of the referenced tag value in bytes.
Referenced Object Device Type	(0029,xx74)	SIEMENS MEDCOM HEADER	1	The Device Type that stores the Child Data Object (CDO) with the referenced tag value. Currently it should be "SHMEM". In future, "SDM", "LOID" or "FILE" are also imaginable. Defined Terms are SHMEM = Shared Memory SDM = Series Data Management LOID = Database FILE

Attribute Name	Tag	Private Creator	Type	Notes
Referenced Object Device Location	(0029,xx75)	SIEMENS MEDCOM HEADER	2	The Location of the device that stores the Child Data Object (CDO) with the referenced tag value. For the "SHMEM" case, it is the shared memory directory. Can be empty, then the default directory will be taken. In future, for "SDM" this will be the SDM_ID, for FILE it will be the directory name and for "LOID" it will be the database name.
Referenced Object ID	(0029,xx76)	SIEMENS MEDCOM HEADER	1	The ID of the object that contains the Child Data Object (CDO) with the referenced tag value. In case of "SHMEM", it is the shared memory ID. In future, for "SDM" this will be a Sirius OID, for "FILE" the file name, for "DB" the LOID.
Series Work Flow Status	(0029,xx60)	SIEMENS MEDCOM HEADER2	3	syngo Patient Browser specific flags used for clinical work: - com = completed - rea = read - ver = verified

8.2.1.1.4 MEDCOM History Information

The value of the attribute MEDCOM History Information (0029,xx20) is defined in the following way:

Table 131: MEDCOM History Information

Part	Name	Type	Bytes	Notes
header	Identifier	string	32	always "CSA HISTORY"
	Version	string	32	e.g. "V1.10"
n items	Class Name	string	64	
	Modification String	string	1024	

8.2.1.1.5 MEDCOM OGG Module

The table in this section contains private IOD Attributes that describe MEDCOM Object Oriented Graphics (OOG). This module is used when object graphics is drawn on the image and need to be stored as graphic object properties (Line, Circle, Rectangle, Arrow, and so on). Given the condition that the module contents was not removed by other modalities, the graphic objects remain re-animatable if such an image was transferred and is then retrieved back.

Table 132: MEDCOM OOG Module

Attribute Name	Tag	Private Creator	Type	Notes
MedCom OOG Type	(0029,xx08)	SIEMENS MEDCOM OOG	1	MEDCOM Object Oriented Graphics (OOG) identification characteristics. Defined Terms: MEDCOM OOG 1
MedCom OOG Version	(0029,xx09)	SIEMENS MEDCOM OOG	3	Version of MEDCOM OOG Info (0029,xx10) format.
MedCom OOG Info	(0029,xx10)	SIEMENS MEDCOM OOG	3	MEDCOM Object Oriented Graphics (OOG) data.

The graphics objects are also stored in one Image overlay plane for compatibility with other products, which don't support the MedCom OOG module. Any system which does not support this MedCom OOG module has to remove these private attributes when modifying the image overlay plane content.

8.2.1.1.6 syngo Report Data

The module contains private IOD Attributes that describe *syngo* reports. This module is used when *syngo* report data are added to DICOM SR and DICOM SC objects.

Table 133: syngo Report Data

Attribute Name	Tag	Private Creator	Type	Notes
syngo Report Type	(0029,xx08)	SIEMENS CSA REPORT	1	syngo report characteristics, e.g. report creating application. Defined Terms: CT_CASCORING CT_CIRCULATION CT_LUNGCARE INSPACE MR_ARGUS This attribute value will be used to identify the corresponding application during generic extension dll management. A restricted character set is used: only A-Z and underscore are supported.
syngo Report Version	(0029,xx09)	SIEMENS CSA REPORT	3	Version of *syngo* Report Data (0029,xx10) format.
syngo Report Data	(0029,xx10)	SIEMENS CSA ENVELOPE	3	Application specific report related data
syngo Report Presentation	(0029,xx11)	SIEMENS CSA ENVELOPE	3	Application specific report related data

Attribute Name	Tag	Private Creator	Type	Notes
SR Variant	(0029,xx15)	SIEMENS CSA REPORT		DICOM SR Variant. Enumerated Values: 0 = Basic Text SR (1.2.840.1008.5.1.4.1.1.88.11) 1 = Enhanced SR (1.2.840.1008.5.1.4.1.1.88.22) 2 = Comprehensive SR (1.2.840.1008.5.1.4.1.1.88.33) 3 = Mammography CAD SR (1.2.840.1008.5.1.4.1.1.88.50) 4 = Key Object Selection Document (1.2.840.1008.5.1.4.1.1.88.59) 5 = Chest CAD SR (1.2.840.1008.5.1.4.1.1.88.65)
SC SOP Instance UID	(0029,xx17)	SIEMENS CSA REPORT	3	DICOM SOP Instance UID of syngo based SC image representing the syngo report object. This UID will be used to identify the Resulting SC object after SR to SC conversion.

8.2.2 Private Attributes in Positron Emission Tomography Image IOD

The following private attributes are defined for PET images.

Table 134: Private Attributes in in Positron Emission Tomography Image IOD

Name	Tag	VR	Explanation
SIEMENS MED PT (0071,0010)			
>Registration Matrix UID	(0071,1021)	UI	UID of Registration matrix between PET and CT images
>Decay Correction DateTime	(0071,1022)	DT	The date and time to which the image was decay corrected. Also refer to (0054,1102)
>Registration Matrix	(0071,1023)	FD	16 float values describing the 4x4 registration matrix from CT to PET. This will always be saved as though CT is the Base and PET is the overlay.
>Table Motion	(0071,1024)	CS	DYNAMIC for CBM, STATIC for Step and Shoot
>Lumped Constant	(0071,1025)	FD	For PET Patlak Images: The lumped constant (LC) used to convert an FDG metabolism to glucose metabolism.
>Histogramming Method	(0071,1026)	CS	For CardioFreezeDual or OncoFreeze Images: Duty Cycle: xx

Name	Tag	VR	Explanation
SIEMENS MED PT MU MAP (0071,001x)			
>SOP Class of Source	(0071,1001)	UI	For mu maps: 1.2.840.10008.5.1.4.1.1.2 for CT based mu maps 1.2.840.10008.5.1.4.1.1.128 for PET based mu maps
>Related Mu Map Series	(0071,1102)	UI	For PET images: DICOM UID of the mu map series which is used for attenuation correction of the PET images

8.2.3 Private Attributes in Radiopharmaceutical Radiation Dose SR IOD

The following private attributes are defined for PET Radiopharmaceutical Radiation Dose Report:

Table 135: Private Attributes in PET Radiopharmaceutical Radiation Dose Report SR IOD

Name	Tag	VR	Explanation
syngo Report Type	(0029,1008)	CS	Value: NMDOSEREPORT
syngo Report Version	(0029,1009)	LO	Value: 1.0
SR Variant	(0029,1015)	US	Value: 8
SC SOP Instance UID	(0029, 1017)	UI	DICOM SOP Instance UID of syngo based SC image representing the syngo report object. This UID is used to identify the resulting SC object after SR to SC conversion.

8.2.4 Private Elements for CT Image Storage SOP Class

The following private attributes are defined for Biograph mCT.

Table 136: Registry of DICOM Data Elements

Tag	Private Owner Code	Name	VR	VM	Notes
(0019,xx90)	SIEMENS CT VA0 COAD	Osteo Offset	DS	1	Offset of the water equivalent material of the Siemens Osteo phantom to real water
(0019,xx92)	SIEMENS CT VA0 COAD	Osteo Regression Line Slope	DS	1	Slope of the regression line for the ESP (=European Spine Phantom) standardization
(0019,xx93)	SIEMENS CT VA0 COAD	Osteo Regression Line Intercept	DS	1	Intercept of the regression line for the ESP (= European Spine Phantom) standardization

Tag	Private Owner Code	Name	VR	VM	Notes
(0019,xx96)	SIEMENS CT VA0 COAD	Osteo Phantom Number	IS	1	Number of the Siemens Osteo phantom
(0019,xxB0)	SIEMENS CT VA0 COAD	Feed per Rotation	DS	1	Som/4 style Feed per Rotation (Backwards Compatibility)
(0019,xxBD)	SIEMENS CT VA0 COAD	Pulmo Trigger Level	IS	1	Spirometer trigger level used for the scan, given in percent of VC (= Vital Capacity) of the patient
(0019,xxBE)	SIEMENS CT VA0 COAD	Expiratoric Reserve Volume	DS	1	ERV (= Exspiratoric Reserve Volume) achieved by the patient
(0019,xxBF)	SIEMENS CT VA0 COAD	Vital Capacity	DS	1	VC (= Vital Capacity) achieved by the patient
(0019,xxC0)	SIEMENS CT VA0 COAD	Pulmo Water	DS	1	Density of the water insert of the Siemens Pulmo phantom
(0019,xxC1)	SIEMENS CT VA0 COAD	Pulmo Air	DS	1	Density of the air holes of the Siemens Pulmo phantom
(0019,xxC2)	SIEMENS CT VA0 COAD	Pulmo Date	DA	1	Date of the evaluation of the Siemens Pulmo phantom
(0019,xxC3)	SIEMENS CT VA0 COAD	Pulmo Time	TM	1	Time of the evaluation of the Siemens Pulmo phantom
(0021xx11)	SIEMENS MED	Target	DS	2	Som/4 style Target (Backwards Compatibility)
0009,00xx	SIEMENS CT VA1 DUMMY	Private Creator Data Element	LO	1	1

8.3 Coded Terminology and Templates

8.3.1 Context Groups

8.3.1.1 Supported Codes for Purpose of Reference Code Sequence

The following table shows supported purposes of Reference Code Sequence (see tag word 0040,A170 in Section 8.1.1.3)

Table 137. Codes for Purpose of Reference Code Sequence

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	122401	Same Anatomy (indicating that the referenced CT series is used for slice matching)
SRT	122403	For Attenuation Correction (indicating that the referenced CT series is used for attenuation correction)

8.3.1.2 Supported Radionuclides for Created PET Images

The following table shows for which radionuclides the Radionuclide Code Sequence is provided for PET Images (see tag word 0054,0300 in section 8.1.1.3):

Table 138: Supported Radionuclides for Created PET Images

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-111A1	^18^Fluorine
SRT	C-159A2	^82^Rubidium
SRT	C-107A1	^13^Nitrogen
SRT	C-105A1	^11^Carbon
SRT	C-128A2	^68^Germanium
SRT	C-155A1	^22^Sodium
SRT	C-1018C	^14^Oxygen
SRT	C-B1038	^15^Oxygen
SRT	C-127A4	^60^Copper
SRT	C-127A1	^61^Copper
SRT	C-127A5	^62^Copper
SRT	C-127A2	^64^Copper
SRT	C-131A1	^66^Gallium
SRT	C-131A3	^68^Gallium
SRT	C-113A1	^75^Bromine
SRT	C-113A2	^76^Bromine
SRT	C-113A3	^77^Bromine
SRT	C-114A5	^124^Iodine

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-135A4	^38^Potassium
SRT	C-149A1	^52^Manganese
SRT	C-163AA	^94m^Technetium
SRT	C-166A2	^45^Titanium
SRT	C-162A3	^86^Yttrium
SRT	C-141A1	^62^Zinc
DCM	126600	^44^Scandium
DCM	126605	^43^Scandium
DCM	126602	^70^Arsenic
SRT	C-115A2	^72^Arsenic
SRT	C-116A2	^72^Selenium
DCM	126603	^90^Niobium
DCM	126606	^152^Terbium
SRT	C-130A1	^52^Iron
DCM	126601	^51^Manganese
SRT	C-162A7	^90^Yttrium
SRT	C-168A4	^89^Zirconium

8.3.1.3 Supported Radiopharmaceuticals for Created PET Images

The following table shows for which radiopharmaceuticals the Radiopharmaceuticals Code Sequence is provided for PET Images (see tag word 0054,0304 in section 8.1.1.3):

Table 139: Supported Radiopharmaceuticals for Created PET Images

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-B1043	Acetate C^11^
SRT	C-B103C	Ammonia N^13^
SRT	C-B07DB	ATSM Cu^64^
SRT	C-B07DC	Butanol O^15^
SRT	C-B103B	Carbon dioxide O^15^
SRT	C-B1045	Carbon monoxide C^11^
SRT	C-B103A	Carbon monoxide O^15^
SRT	C-B103F	Carfentanil C^11^
SRT	C-B07DD	EDTA Ga^68^
SRT	C-B07DE	Flumazenil C^11^
SRT	C-B07DF	Flumazenil F^18^

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-B07E0	Fluorethyltyrosin F^18^
SRT	C-B1031	Fluorodeoxyglucose F^18^
SRT	C-B07E1	Fluoromisonidazole F^18^
SRT	C-B07E2	Fluoromethane F^18^
SRT	C-B07E3	Fluorouracil F^18^
SRT	C-B07E4	Fluorobenzothiazole F^18^
SRT	C-B1034	Fluoro-L-dopa F^18^
SRT	C-B1046	Germanium Ge^68^
SRT	C-B103D	Glutamate N^13^
SRT	C-B07E5	Mespiperone C^11^
SRT	C-B103E	Methionine C^11^
SRT	C-B07E6	Monoclonal antibody I^124^
SRT	C-B1038	Oxygen O^15^
SRT	C-B1039	Oxygen-water O^15^
SRT	C-B1044	Palmitate C^11^
SRT	C-B07E7	PTSM Cu^62^
SRT	C-B1042	Raclopride C^11^
SRT	C-B1037	Rubidium chloride Rb^82^
SRT	C-B1032	Sodium fluoride F^18^
SRT	C-B07E8	Sodium iodide I^124^
SRT	C-B1047	Sodium Na^22^
SRT	C-B1033	Spiperone F^18^
SRT	C-B1036	Thymidine (FLT)F^18^
DCM	126713	2FA F^18^
DCM	126700	ATSM Cu^60^
DCM	126701	ATSM Cu^61^
DCM	126702	ATSM Cu^62^
DCM	126516	Bevacizumab ^89^Zr
DCM	126513	Cetuximab ^89^Zr
DCM	126703	Choline C^11^
DCM	126517	cG250-F(ab')(2) ^89^Zr
DCM	126715	CLR1404 I^124^
DCM	126515	cU36 ^89^Zr
DCM	126520	Df-CD45 ^89^Zr

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	126519	E4G10 ^89^Zr
UMLS	C2713594	Edotreotide Ga^68^
DCM	126704	Fallypride C^11^
DCM	126705	Fallypride F^18^
DCM	126706	FLB 457 C^11^
DCM	126503	Flubatine F^18^
DCM	126501	Florbetaben F^18^
SRT	C-E0269	Florbetapir F^18^
SRT	C-E0265	Fluciclatide F^18^
SRT	C-E026A	Fluciclovine F^18^
UMLS	C1831937	Fluoroestradiol (FES) F^18^
UMLS	C1541539	Fluoroetanidazole F^18^
SRT	C-E0273	Fluorocholine F^18^
UMLS	C2934038	Fluoropropyl-dihydrotetrabenazine (DTBZ) F^18^
DCM	126707	Fluorotriopride F^18^
SRT	C-E0267	Flutemetamol F^18^
DCM	126709	Glutamine C^11^
DCM	126711	Glutamine F^18^
UMLS	C2981788	ISO-1 F^18^
DCM	126514	J591 ^89^Zr
DCM	126510	Monoclonal Antibody (mAb) ^64^Cu
DCM	126511	Monoclonal Antibody (mAb) ^89^Zr
DCM	126714	Nifene F^18^
DCM	126500	Pittsburgh compound B C^11^
DCM	126518	R1507 ^89^Zr
DCM	126502	T807 F^18^
DCM	126512	Trastuzumab ^89^Zr
UMLS	C1742831	tyrosine-3-octreotate Ga^68^
DCM	126752	28H1 ^89^Zr
DCM	126751	7D12 ^89^Zr
DCM	126750	7E11 ^89^Zr
DCM	126729	AGN-150998 ^89^Zr

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	126754	Anti-B220 ^89^Zr
DCM	126722	Benralizumab ^89^Zr
DCM	126727	Blinatumomab ^89^Zr
DCM	126735	Brentuximab ^89^Zr
DCM	126746	cMAb U36 ^89^Zr
DCM	126762	Df-[FK](2) ^89^Zr
DCM	126763	Df-[FK](2)-3PEG(4) ^89^Zr
DCM	126760	Df-FK ^89^Zr
DCM	126761	Df-FK-PEG(3) ^89^Zr
DCM	126747	DN30 ^89^Zr
DCM	126732	Ecromeximab ^89^Zr
DCM	126748	Fresolimumab ^89^Zr
DCM	126731	GA201 ^89^Zr
DCM	126724	Glembatumumab vedotin ^89^Zr
DCM	126740	Margetuximab ^89^Zr
DCM	126730	MEDI-551 ^89^Zr
DCM	126738	Mogamulizumab ^89^Zr
DCM	126753	Nanocolloidal albumin ^89^Zr
DCM	126721	Obinituzimab ^89^Zr
DCM	126723	Ocaratuzumab ^89^Zr
DCM	126736	Panitumumab ^89^Zr
DCM	126728	Pegdinetanib ^89^Zr
DCM	126725	Pinatuzumab vedotin ^89^Zr
DCM	126726	Polatuzumab vedotin ^89^Zr
DCM	126742	Ranibizumab ^89^Zr
DCM	126737	Rituximab ^89^Zr
DCM	126755	RO5323441 ^89^Zr
DCM	126756	RO542908 ^89^Zr
DCM	126733	Roledumab ^89^Zr
DCM	126741	SAR3419 ^89^Zr
DCM	126749	TRC105 ^89^Zr
DCM	126739	Ublituximab ^89^Zr

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	126734	XmAb5574 ^89^Zr

8.3.1.4 Supported Radionuclides for Created PET RRDSR Instances

A limited subset of radionuclides is supported for PET RRDSRs. The following table shows for which radionuclides the Radionuclide Code Sequence is provided for PET RRDSRs (see tag word 0054,0300 in section 8.1.1.3):

Table 140: Supported Radionuclides for Created PET RRDSR Instances

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-111A1	^18^Fluorine
SRT	C-159A2	^82^Rubidium
SRT	C-107A1	^13^Nitrogen
SRT	C-105A1	^11^Carbon
SRT	C-155A1	^22^Sodium
SRT	C-B1038	^15^Oxygen

8.3.1.5 Supported Radiopharmaceuticals for Created PET RRDSR Instances

A limited subset of Radiopharmaceuticals is supported for PET RRDSRs. The following table shows for which radiopharmaceuticals the Radiopharmaceuticals Code Sequence is provided for PET RRDSRs (see tag word 0054,0304 in section 8.1.1.3):

Table 141: Supported Radiopharmaceuticals for Created PET RRDSR Instances

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-B1043	Acetate C^11^
SRT	C-B103C	Ammonia N^13^
SRT	C-B103F	Carfentanil C^11^
SRT	C-B07E0	Fluorethyltyrosin F^18^
SRT	C-B1031	Fluorodeoxyglucose F^18^
SRT	C-B1034	Fluoro-L-dopa F^18^
SRT	C-B103E	Methionine C^11^
SRT	C-B1039	Oxygen-water O^15^
SRT	C-B1042	Raclopride C^11^
SRT	C-B1037	Rubidium chloride Rb^82^
SRT	C-B1032	Sodium fluoride F^18^
SRT	C-B1036	Thymidine (FLT)F^18^

8.3.1.6 Organs used for Reporting in Created PET RRDSR Instances

The following table shows the organs for which Organ Dose will be reported along with the corresponding laterality. Testis only included for patient sex "M". Ovary and Uterus only included for patient sex "F".

Table 142: Organs used for Reporting in Created PET RRDSR Instances

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	Laterality
SRT	T-B3000	Adrenal gland	Right and Left
SRT	T-D0859	Bone Surface	N/A
SRT	T-A0100	Brain	N/A
SRT	T-04000	Breast	Right and Left
SRT	T-63000	Gall bladder	N/A
SRT	T-57000	Stomach	N/A
SRT	T-58000	Small intestine	N/A
SRT	T-59300	Colon	N/A
SRT	T-32000	Heart	N/A
SRT	T-71000	Kidney	Right and Left
SRT	T-62002	Liver	N/A
SRT	T-28000	Lung	Right and Left
SRT	T-13001	Muscle	N/A
SRT	T-56000	Esophagus	N/A
SRT	T-65000	Pancreas	N/A
SRT	T-C1000	Bone Marrow	N/A
SRT	T-00009	Skin	N/A
SRT	T-C3000	Spleen	N/A
SRT	T-87000	Ovary	Right and Left
SRT	T-83000	Uterus	N/A
SRT	T-94000	Testis	Right and Left
SRT	T-C8000	Thymus	N/A
SRT	T-B6000	Thyroid	N/A
SRT	T-74000	Bladder	N/A

8.3.2 Template Specifications

8.3.2.1 RRDSR Structured Report IOD Templates

The RRDSR generally follows the templates defined in the DICOM Standard "Radiopharmaceutical Radiation Dose" (TID 10021), "Radiopharmaceutical Administration Event" (TID 10022), "Radiopharmaceutical Administration Patient Characteristics" (TID 10024) and supports all mandatory elements.

Figure 1 shows the hierarchy of templates used to create instances of the Radiopharmaceutical Radiation Dose SR IOD.

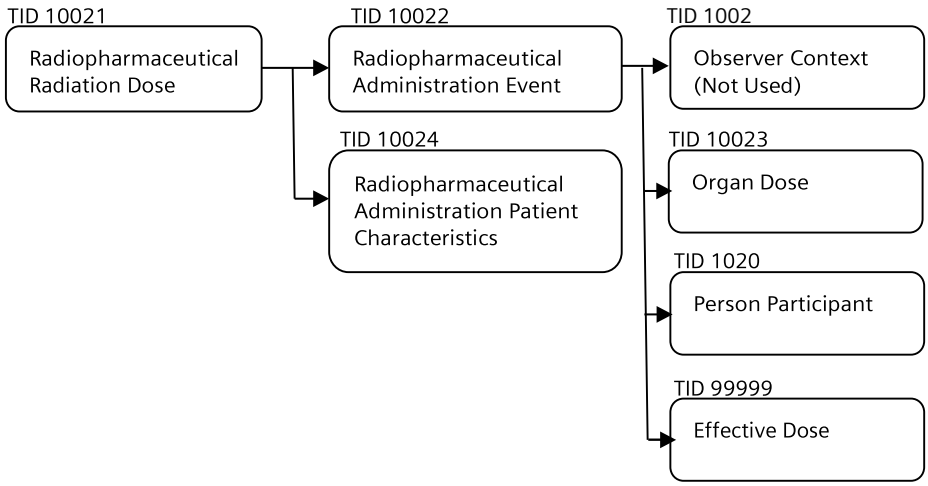


Figure 1: Hierarchy of Templates in Radiopharmaceutical Radiation Dose SR

Not all the organs from ICRP publications are encoded using TID 10023 (e.g. Remaining Organs, Other Tissues), as these are included in the effective dose, but not included as individual organs as there are no corresponding DICOM-conformant coded terms for these organs (or sets of organs) at this time.

For dose reports with ICRP 53 as a reference authority, the following method is used to calculate the organ absorbed dose for the Colon Wall using the organ dose values for Upper Large Intestine (ULI) and Lower Large Intestine (LLI).

Colon = 0.57ULI + 0.43LLI

The following tables contain the expected content.

8.3.2.1.1 TID 10021 Radiopharmaceutical Radiation Dose

Table 143: TID 10021 Radiopharmaceutical Radiation Dose

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (113500, DCM, “Radiopharmaceutical Radiation Dose SR“)	AUTO	Root node
>	HAS CONCEPT MOD	CODE	EV (G-C2D0, SRT, “Associated Procedure)	AUTO	Always (P5-0A00A,SRT,"PET study for localization of tumor")
>>	HAS CONCEPT MOD	CODE	EV (G-C0E8, SRT, "Has Intent")	AUTO	Always (R-408C3,SRT,"Diagnostic Intent")
>	CONTAINS	INCLUDE	DTID 10022 " Radiopharmaceutical Administration Event Data"	AUTO	See Table 144: TID 10022 Radiopharmaceutical Administration Event
>	CONTAINS	INCLUDE	DTID 10024 “Imaging Agent Administration Patient Characteristics”	AUTO	See Table 145: TID 10024 Imaging Agent Administration Patient Characteristics

8.3.2.1.2 TID 10022 Radiopharmaceutical Administration Event

Table 144: TID 10022 Radiopharmaceutical Administration Event

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (113502, DCM," Radiopharmaceutical Administration")	AUTO	
>	CONTAINS	CODE	(F-61FDB, SRT," Radiopharmaceutical agent")	AUTO	See Table 141: Supported Radiopharmaceuticals
>>	HAS PROPERTIES	CODE	(C-10072, SRT," Radionuclide")	AUTO	See Table 140: Supported Radionuclides
>>	HAS PROPERTIES	NUM	(R-42806, SRT, "Radionuclide Half Life")	AUTO	Unit (s,UCUM,"seconds")
>	CONTAINS	UIDREF	(113503, DCM, "Radiopharmaceutical Administration Event UID")	AUTO	
>	CONTAINS	DATETIME	(123003, DCM, "Radiopharmaceutical Start DateTime")	AUTO	
>	CONTAINS	DATETIME	(123004, DCM, "Radiopharmaceutical Stop DateTime")	AUTO	
>	CONTAINS	NUM	(113507, DCM, "Administered activity")	AUTO	
>	CONTAINS	INCLUDE	(113517, DCM, "Organ Dose Information")	AUTO	One CONTAINER for each (Organ) Finding Site. See Table 147: TID 10023 Organ Dose

8.3.2.1.3 TID 10024 Imaging Agent Administration Patient Characteristics

Table 145: TID 10024 Imaging Agent Administration Patient Characteristics

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	(121118, DCM, "Patient Characteristics")	AUTO	
>	CONTAINS	NUM	(121033, DCM, "Subject Age")	MWL/USER	Unit (a,UCUM,"year")
>	CONTAINS	CODE	EV (121032,DCM,"Subject Sex")	MWL/USER	Use DCID 7455 „Sex“
>	CONTAINS	NUM	(8302-2, LN, "Patient Height")	MWL/USER	Unit (cm, UCUM, “cm”)
>	CONTAINS	NUM	(29463-7 ,LN, "Patient Weight")	MWL/USER	Unit (kg,UCUM,"kg")

8.3.2.1.4 TID 1020 Person Participant

Table 146: TID 1020 Person Participant

NL	Rel with Parent	VT	Concept Name	Source	Values
	HAS OBS CONTEXT	PNAME	(113870, DCM, "Person Name")	AUTO	Always “Unknown“ because the person doing the injection is not known by the system.

NL	Rel with Parent	VT	Concept Name	Source	Values
>	HAS PROPERTIES	CODE	(113875, DCM, "Person Role in Procedure")	AUTO	(113851, DCM, "Irradiation Administering")

8.3.2.1.5 TID 1020 Person Participant

Table 147: TID 10023 Organ Dose

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	(113517, DCM, "Organ Dose Information")	AUTO	One CONTAINER for each Finding Site
>	HAS CONCEPT MOD	CODE	(G-C0E3,SRT,"Finding Site")	AUTO	See Table 142: Organs used for Reporting in Created PET RRDSR Instances
>	HAS CONCEPT MOD	CODE	(G-C171, SRT, "Laterality")	AUTO	Provided if Finding Site has a laterality See Table 142: Organs used for Reporting in Created PET RRDSR Instances
>	CONTAINS	NUM	(113518, DCM,"Organ Dose")	AUTO	Unit (mGy, UCUM,"mGy")
>>	HAS PROPERTIES	TEXT	(121406, DCM, "Reference Authority")	AUTO	"ICRP Publication 128" for all Radiopharmaceuticals except N-13 Ammonia in which case value will be "ICRP Publication 53"

8.3.2.1.6 TID 99999 Effective Dose

Table 148: TID 99999 Effective Dose

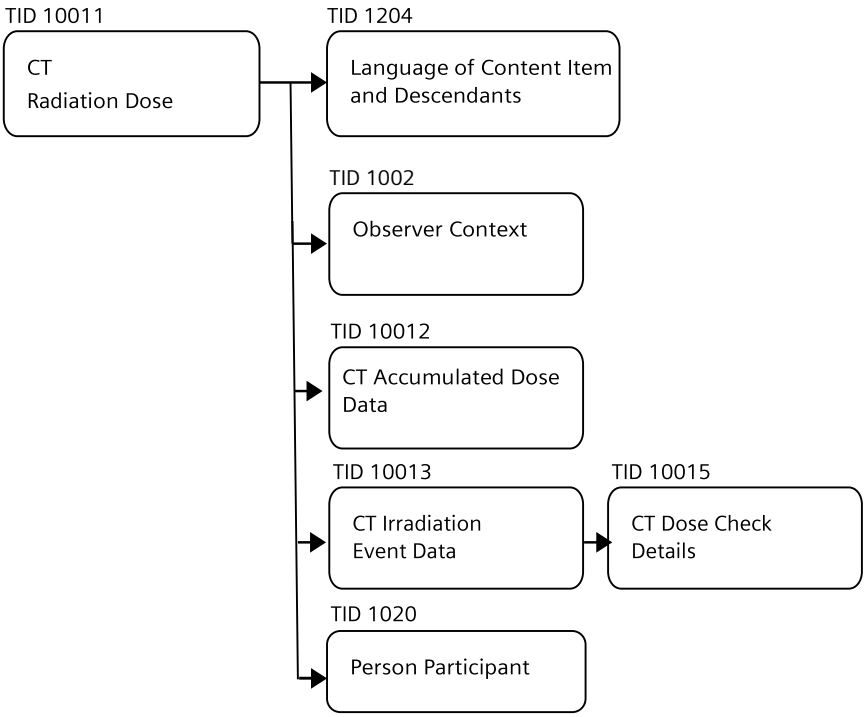
NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	(220001, 99SHS, "Effective Dose Information")	AUTO	One CONTAINER. See Table 155. Private Codes used in Radiopharmaceutical Radiation Dose SR
>	CONTAINS	NUM	(113839, DCM, "Effective Dose ")	AUTO	Unit (mSv, UCUM,"mSv")
>>	HAS PROPERTIES	TEXT	(121406, DCM, "Reference Authority")	AUTO	"ICRP Publication 128" for all Radiopharmaceuticals except N-13 Ammonia in which case value will be "ICRP Publication 53"

8.3.2.2 CT Radiation Dose SR IOD Templates

The CT Radiation Dose SR complies with the templates defined in the DICOM Standard "CT Radiation Dose" (TID 10011), "CT Accumulated Dose Data" (TID 10012), "CT Irradiation Event Data" (TID 10013), and "CT Dose Check Details" (TID 10015) and supports all mandatory elements.

Figure 2 shows the hierarchy of templates used to create instances of the CT Radiation Dose SR IOD.

Figure 2: Hierarchy of Templates in CT Radiation Dose SR



The following tables contain the content of the CT Radiation Dose SR

8.3.2.2.1 TID 10011 CT Radiation Dose

Table 149: TID 10011 CT Radiation Dose

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (113701, DCM, "X-Ray Radiation Dose Report")	AUTO	Root node
>	HAS CONCEPT MODP	CODE	EV (121058, DCM, "Procedure Reported")	AUTO	(7747700, SCT, "Computed Tomography X-Ray")
>>	HAS CONCEPT MOD	CODE	EV (G-C0E8, SRT, "Has Intent")	AUTO	Always (R-408C3,SRT,"Diagnostic Intent")
>		INCLUDE	DTID 1002 "Observer Context"	AUOT	See Table 150: TID 1002 Observer Context
>	HAS OBS CONTEXT	DATETIME	EV (113809, DM; "Start of X-Ray Irradiation"	AUTO	
>	HAS OBS CONTEXT	DATETIME	EV (113810, DM; "End of X-Ray Irradiation"	AUTO	
>	HAS OBS CONTEXT	CODE	EV (113705, "Scope of Accumulation")	AUTO	(113014, DCM, "Study")
>>	HAS PROPERTIES	UIDREF	EV (111080, DCM, "Study Instance UID")	AUTO	
>	CONTAINS	INCLUDE	DTID 10012 "CT Accumulated Dose Data")	AUTO	See Table 152: TID 10012 CT Accumulated Dose Data
>	CONTAINS	INCLUDE	DTID 10013, " CT Irradiation Event Data")	AUTO	For each Irradiation Event see Table 153: TID 10013 CT Irradiation Event Data
>	CONTAINS	CODE	EV (113854, DCM, "Source of Dose Information	AUTO	(113856,DCM,"Automated Data Collection")

8.3.2.2.2 TID 1002 Observer Context

Table 150: TID 1002 Observer Context

NL	Rel with Parent	VT	Concept Name	Source	Values
	HAS OBS CONTEXT	CODE	EV (121005, DCM, Observer Type"	AUTO	(121007, DCM, Device")
>	HAS OBS CONTEXT	INCLUDE	DTID 1004 "Device Observer Identifying Attributes"	AUTO	See Table 151: TID 1004 Device Observer Identifying Attributes

8.3.2.2.3 TID 1004 Device Observer Identifying Attributes

Table 151: TID 1004 Device Observer Identifying Attributes

NL	Rel with Parent	VT	Concept Name	Source	Values
		UIDREF	EV (121012, DCM, "Device Observer UID")	AUTO	
		TEXT	EV (121013, DCM, "Device Observer Name")	AUTO	Table 111
		TEXT	EV (121014, DCM, "Device Observer Manufacturer")	AUTO	"SIEMENS"
		TEXT	EV (121015, DCM, "Device Observer Model Name")	AUTO	Table 121
		TEXT	EV (121016, DCM, "Device Observer Serial Number")	AUTO	Table 111
		TEXT	EV (121017. "Device Observer Physical Location")	AUTO	"Hospital"

8.3.2.2.4 TID 10012 CT Accumulated Dose Data

Table 152: TID 10012 CT Accumulated Dose Data

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (1138,11, DCM,(" CT Accumulated Dose Data")	AUTO	
>	CONTAINS	NUM	EV (113812, DCM, "Total Number of Irradiation Events")	AUITO	Unit ({events}, UCUM, "events")
>	CONTAINS	NUM	EV (113813, DCM, "CT Dose Length Product")	AUTO	Unit (mGy.cm, UCUM, "mGy.cm")

8.3.2.2.5 TID 10013 CT Irradiation Event Data

Table 153: TID 10013 CT Irradiation Event Data

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (113819, DCM, "CT Acquisition")	AUTO	
>	CONTAINS	TEXT	EV (125203, DCM, "Acquisition Protocol"	AUTO	"Topogram"
>	CONTAINS	CODE	EV (123014, DCM, "Target Region"	AUTO	See DCID 4030 "CT, MR, and PET Anatomy"

NL	Rel with Parent	VT	Concept Name	Source	Values
>	CONTAINS	CODE	EV (123820, DCM, “Acquisition Type”	AUTO	(113805,DCM,"Constant Angle Acquisition")
>	CONTAINS	CODE	EV (408730004, SCT, “Procedure Context”	AUTO	(P5-0808E,SRT,"CT without contrast"
>	CONTAINS	UIDREF	EV (113769, DCM, “Irradiation Event UID”)	AUTO	
>	CONTAINS	CONTAINER	EV (1138,22, DCM, “Acquisition Parameters”)	AUTO	
>>	CONTAINS	NUM	EV (113824, DCM, “Exposure Time”)	AUTO	Unit (s,UCUM[1.4],"s")
>>	CONTAINS	NUM	EV (113825, DCM, “Scanning Length”)	AUTO	Unit (mm,UCUM[1.4],"mm")
>>	CONTAINS	NUM	EV(223826, DCM, "Nominal Single Collimation Width")	AUTO	Unit (mm,UCUM[1.4],"mm")
>>	CONTAINS	NUM	EV (113827, DCM, "Nominal Total Collimation Width")	AUTO	Unit (mm,UCUM[1.4],"mm")
>>	CONTAINS	NUM	EV (113823, DCM, "Number of X-Ray Sources")	AUTO	Unit ({X-Ray sources},UCUM[1.4],"X-Ray sources"
>>	CONTAINS	CONTAINER	EV (113831,DCM,"CT X-Ray Source Parameters")	AUTO	
>>>	CONTAINS	TEXT	EV (113832, DCM, "Identification of the X-Ray Source")	AUTO	“A”
>>>	CONTAINS	NUM	EV (113733, DCM, “KVP”)	AUTO	Unit (kV,UCUM,"kV")
>>>	CONTAINS	NUM	EV (113833, DCM, “Maximum X-Ray Tube Current”)	AUTO	Unit (mA,UCUM,"mA")
>>>	CONTAINS	NUM	EV (113734, DCM, “X-Ray Tube Current”	AUTO	Unit (mA,UCUM,"mA")
>	CONTAINS	CONTAINER	EV (113829, DCM, "CT Dose")	AUTO	
>>	CONTAINS	NUM	EV (113830, DCM, "Mean CTDIvol")	AUTO	Unit (mGy,UCUM,"mGy")
>>	CONTAINS	CODE	EV (113835, DCM, "CTDIw Phantom Type")	AUTO	(113691, DCM, "IEC Body Dosimetry Phantom")
>>	CONTAINS	NUM	EV (113838, DCM, "DLP")	AUTO	Unit (mGy.cm, UCUM, "mGy.cm")
>>	CONTAINS	INCLUDE	DTID 10015 “CT Dose Check Details	AUTO	See Table 154: TID 10015 CT Dose Check Details
>	CONTAINS	TEXT	EV (113842, DCM, “X-Ray Modulation Type”)	AUTO	“XYZ_EC”
>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	AUTO	"Internal technical scan parameters: Organ Characteristic = Abdomen, Body Size = Adult, Body Region = Body, X-ray Modulation Type = XYZ_EC, Sn Filter (Tube A) = no"
>	CONTAINS	INCLUDE	DTID 100015, “CT Dose Check Details”)	AUTO	See Table 154: TID 10015 CT Dose Check Details

8.3.2.2.6 TID 10015 CT Dose Check Details

Table 154: TID 10015 CT Dose Check Details

NL	Rel with Parent	VT	Concept Name	Source	Values
		CONTAINER	EV (113900, DM; "Dose Check Alert Details")	AUTO	
>	CONTAINS	CODE	EV (113901, DCM, "DLP Alert Value Configured	AUTO	(R-00339,SRT,"No")
>	CONTAINS	CODE	EV (113902, "CTDIvol Alert Value Configured")	AUTO	(R-0038D,SRT,"Yes")
>	CONTAINS	NUM	EV (113904, DCM, "CTDIvol Alert Value")	AUTO	1000 Unit (mGy,UCUM,"mGy")
		CONTAINER	EV (113908, DM; "Dose Check Notification Details")	AUTO	
>	CONTAINS	CODE	EV (113909, DCM, "DLP Notification Value Configured	AUTO	(R-00339,SRT,"No")
>	CONTAINS	CODE	EV (113910, "CTDIvol Notification Value Configured")	AUTO	(R-00339,SRT,"No")

8.3.3 Private Code Definitions

8.3.3.1 Private Codes in Radiopharmaceutical Radiation Dose SR

The following table shows private codes used in the PET Radiopharmaceutical Radiation Dose Report

Table 155. Private Codes used in Radiopharmaceutical Radiation Dose SR

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SHS	220001	Effective Dose Information

8.4 Grayscale Image Consistency

N/A

8.5 Standard Extended / Specialized / Private SOP Classes

8.5.1 Standard Extensions

8.5.1.1 Standard Extensions for CT SOP Classes

The following tables list the data dictionary of all DICOM IOD attributes where the DICOM standard definitions are extended:

Table 156: Standard Extensions of CT SOP Classes

Attribute Name	Tag	Type	Notes
Image Type	(0008,0008)	1	See Section 8.5.1.1.1 (Image Type) and Table 160: Image Type (0008,0008) for objects created by Biograph mCT for further explanation. additional Defined Terms for value 3:

Attribute Name	Tag	Type	Notes
			OTHER MPR PROJECTION IMAGE UNDEFINED Defined Terms for value 4: CSA *[22] CT_SOM4 * CT_SOM5 * ECAT * SHS * Biograph mCT provides a value 5 with the Defined Terms: ADD CTL FINISHED IN_WORK MRTD OTOM OTOP PBF PBV PKET PMON STD TTP TTS Biograph mCT provides a value 6 with the Defined Terms: DNRG SNRG Biograph mCT provides a value 7 with the Defined Terms: DET_A DET_B
Body Part Examined	(0018,0015)	3	Additional Defined Terms for the PETsyngo based SOMATOM products: SPINE SPECIAL UNKNOWN

[22] For terms beginning with the stated prefix, e. g. "CSA", and ending with a "*" ,
see 8.5.1.1.1 Image Type on pg 174.

Attribute Name	Tag	Type	Notes
			SERVICE PARTIALBODY See 5.1.1.2 and for further explanation.

All SOP classes may contain additional type 3 attributes which DICOM standard defines in a different DICOM IOD or DICOM SOP class (attributes from Normalized SOP classes).
This is the case for example for

- Rescale Slope (0028,1053)
- Rescale Intercept (0028,1052)

which are also used in the MR IOD.

8.5.1.1.1 Image Type

The Image Type (0008,0008) attribute identifies important image identification characteristics. These characteristics are:

1. Pixel Data Characteristics:

- is the image an ORIGINAL Image; an image whose pixel values are based on original or source data, or
- is the image a DERIVED Image; an image whose pixel values have been derived in some manner from the pixel value of one or more other images.

2. Patient Examination Characteristics:

- is the image a PRIMARY Image; an image created as a direct result of the Patient examination, or
- is the image a SECONDARY Image; an image created after the initial Patient examination.

3. Modality Specific Characteristics (SOP Specific Characteristics).

4. Implementation specific identifiers; other implementation specific identifiers shall be documented in an implementation's conformance claim.

The Image Type attribute is multi-valued and shall be provided in the following manner:

Value 1 shall identify the Pixel Data Characteristics; Enumerated Values for the Pixel Data Characteristics are:
- ORIGINAL = identifies an Original Image
- DERIVED = identifies a Derived Image

Value 2 shall identify the Patient Examination Characteristics; Enumerated Values for the Patient Examination Characteristics are:
- PRIMARY = identifies a Primary Image
- SECONDARY = identifies a Secondary Image

Value 3 shall identify any Image IOD specific specialization, the following terms are defined in addition to the DICOM standard definitions:
- OTHER = converted non-Axial and non-Localizer CT images; images of no special type (new syntax)
- MPR = 3D MPR images (MR)
- PROJECTION IMAGE = 3D MIP and SSD images (MR)
- UNDEFINED = images of no special type (old syntax)

Value 4 is implementation specific. The following terms are defined:

- original syngo generated data set types:

  CSA 3D EDITOR = object created by 3D Editor
  CSA 3D FLY PATH = object created by Fly Through Path
  CSA 3D FLY VRT = object created by Fly Through Volume Rendering Technique
  CSA 3D FUSION = object created by Fusion

CSA AVERAGE = image was created by Average
CSA BLACK IMAGE = SC Image with black pixels, only graphics information is of interest
CSA BOOKMARK = InSpace generated SC image containing bookmark information
CSA RESAMPLED = derived image created by zooming or panning original image
CSA REPORT = *syngo* Reporting (documentation of diagnosis)
CSA RESULT = *syngo* Reporting (post processing results)
CSA MIP = image created by Maximum Intensity Projection
CSA MIP THIN = image created by Maximum Intensity Projection
CSA MIP THIN CV = image created by Maximum Intensity Projection (curved cut)
CSA MPR = image created by Multi Planar Reconstruction
CSA MPR CV = image created by Multi Planar Reconstruction (curved cut)
CSA MPR THICK = image created by Multi Planar Reconstruction
CSA MPR THICK CV = image created by Multi Planar Reconstruction (curved cut)
CSA MPR THIN = image created by Multi Planar Reconstruction
CSA PSSD = SC image as Perspective Shaded Surface Display
CSA SSD = SC Image as Shaded Surface Display
CSA SUBTRACT = image was created by Subtraction
CSA VRT = SC Image created by Volume Rendering Technique
ECAT ACF = CTI PET Attenuation Correction
ECAT NORMAL = CTI PET Normalization
ECAT 3D SINO = CTI PET 3D Sinogram Short
ECAT 3D SINO FLT = CTI PET 3D Sinogram Float

- additional image types generated by Biograph mCT

CT_SOM5 AVE = Averaged Image
CT_SOM5 ICD = Interventional Cine Display Image
CT_SOM5 MON = Monitoring or Premonitoring Image
CT_SOM5 MUL = Multiscan Image
CT_SOM5 PAR = Parameter Image
CT_SOM5 PROT = Protocol Image
CT_SOM5 ROT = ROT Image
CT_SOM5 RTD = Real Time Display Image
CT_SOM5 SEQ = Sequence Image
CT_SOM5 SPI = Spiral Image
CT_SOM5 SPO = Spiral Oblique Image
CT_SOM5 STA = Static Image
CT_SOM5 SUB = Subtracted Image
CT_SOM5 TOP = Topogram
CT_SOM5 DPAN = Dental Panorama Rebuilt Tomogram
CT_SOM5 DPAR = Dental Paraxial Rebuilt Tomogram
CT_SOM5 DFLM = Dental Filming Image
CT_SOM5 DYB = Dynamic Evaluation Averaged Baseline Image
CT_SOM5 DYF = Dynamic Evaluation Fused Multislice Image
CT_SOM5 PEVI = Pulmo Evaluation Image
CT_SOM5 OEVA = Osteo Evaluated Tomogram
CT_SOM5 MIP = Maximum Intensity Projection image created by a CT application
CT_SOM5 MPR = Multi Planar Reconstruction image created by a CT application
CT_SOM5 REP = Lung Care Report Image

- converted images

CT_SOM4 NONE = converted SOMARIS image
CT_SOM4 CONV = converted SOMARIS Convolution Kernel file
CT_SOM4 DART = converted SOMARIS Dental Artificial image
CT_SOM4 DEVA = converted SOMARIS Dental Evaluation image
CT_SOM4 DGRA = converted SOMARIS Dental Graphics image
CT_SOM4 DMEA = converted SOMARIS Dynamic Measurement image
CT_SOM4 DPAN = converted SOMARIS Dental Panorama image
CT_SOM4 DPAR = converted SOMARIS Dental Paraxial image
CT_SOM4 EBT = converted SOMARIS Evolution image
CT_SOM4 HIS = converted SOMARIS Histogram Graphics image
CT_SOM4 HISC = converted SOMARIS Histogram Graphics image
CT_SOM4 MUL = converted SOMARIS Multiscan image
CT_SOM4 OEVA = converted SOMARIS Osteo Evaluation image
CT_SOM4 OTOM = converted SOMARIS Osteo Tomogram image
CT_SOM4 OTOP = converted SOMARIS Osteo Topogram image
CT_SOM4 PLOT = converted SOMARIS Plot image
CT_SOM4 QUAL = converted SOMARIS Quality image
CT_SOM4 R2D = converted SOMARIS 2D Rebuild image
CT_SOM4 R3D = converted SOMARIS 3D Rebuild image
CT_SOM4 R3DE = converted SOMARIS 3D Rebuild image
CT_SOM4 RMAX = converted SOMARIS Maximum Intensity Projection image
CT_SOM4 RMIN = converted SOMARIS Minimum Intensity Projection image
CT_SOM4 ROT = converted SOMARIS Rotation Mode image
CT_SOM4 RRAD = converted SOMARIS Radiographic Projection image
CT_SOM4 RVIT = converted SOMARIS Vessel Image Tool image
CT_SOM4 RVRT = converted SOMARIS Volumetric Rendering image
CT_SOM4 SAVE = converted SOMARIS Evolution Screen Save image
CT_SOM4 SCAN = converted SOMARIS Standard Mode image
CT_SOM4 SEQ = converted SOMARIS Sequence Mode image
CT_SOM4 SER = converted SOMARIS Serial Mode image
CT_SOM4 SIN = converted SOMARIS Sinogram image
CT_SOM4 SINC = converted SOMARIS Sinogram image
CT_SOM4 SPI = converted SOMARIS Spiral Mode image
CT_SOM4 STA = converted SOMARIS Static Mode image
CT_SOM4 TAB = converted SOMARIS Correction Table image
CT_SOM4 TOP = converted SOMARIS Topogram image
CT_SOM4 GTOP = converted SOMARIS Topo Graphics image
CT_SOM4 PEVG = converted SOMARIS Pulmo Evaluation image
CT_SOM4 PEVI = converted SOMARIS Pulmo Evaluation image
CT_SOM4 PUL = converted SOMARIS Pulmo Respiration curve
CT_SOM4 PROT = converted SOMARIS Protocol image
CT_SOM4 TEXT = converted SOMARIS Text image
CT_SOM4 ICD = converted SOMARIS Interventional Cine image

SHS DENT = converted MagicView Dental Tomogram image
SHS DPAN = converted MagicView Dental Panorama image
SHS DPAR = converted MagicView Dental Paraxial image
SHS 3D_CURVED = converted MagicView image
SHS 3D_MIP = converted MagicView Maximum Intensity Projection image
SHS 3D_MPR = converted MagicView Multi Planar Reconstruction image

SHS 3D_SSD = converted MagicView Shaded Surface Display image

SHS 3D_VRT = converted MagicView Volumetric Rendering image

Value 5 is specific for the Biograph mCT. In special cases (3D postprocessing) values mentioned for a lower index may appear for value 5 or higher. This will refer to 3D postprocessing base image types. The following terms are defined:

- ADD = Additional Scan
- ALP = Arterial Liver Perfusion
- CTL = Control Scan
- HPI = Hepatic Perfusion Index
- FINISHED = Lung Care Report Image (finished)
- IN_WORK = Lung Care Report Image (not finished)
- MRTD = Multiscan Real Time Display Image
- OTOM = Osteo Scanned Tomogram
- OTOP = Osteo Scanned Topogram
- PBF = Perfusion Blood Flow Image
- PBV = Perfusion Blood Volume Image
- PKET = Peak Enhancement Parameter Image
- PMON = Premonitoring Scan
- PVP = Portal Venous Liver Perfusion
- RT3D CONFIG = InSpace Configuration Image
- STD = Standard image of corresponding Type 4
- TTP = Time to Peak Parameter Image
- TTS = Time to Start Parameter Image

8.5.1.1.2 Body Part Examined

The Body Part Examined (0018,0015) attribute provides a textual description of the part of the body examined. The Biograph mCT extends the Defined Terms:

- SPINE = Summary term used instead of the Defined Terms CSPINE, TSPINE, LSPINE, and SSPINE
- SPECIAL = Image was acquired with acquisition modes that are not mapped to a certain part of the body
- SERVICE = Image was acquired for maintenance purpose
- UNKNOWN = No information about the body part available
- PARTIALBODY = Range used by PET Fast Planning

See Section 8.5.2.1 for a mapping of the organ characteristics used for examination to the Body Part Examined terms.
In addition, the user interface permits the definition of new terms by the user. So in fact any syntactically correct value may be present as a value of this attribute. It is recommended, though, to use the DICOM defined terms when appropriate.

8.5.1.1.3 RGB color images

The Biograph mCT DICOM application extends the CT Image IOD by the use of RGB color image description with the unsigned integer 24-bit color image plane pixel format:

- samples per pixel (attribute 0028, 0002) = 3
- photometric interpretation (attribute 0028,0004) = “RGB”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8
- bits stored (attribute 0028,0101) = 8
- high bit (attribute 0028,0102) = 7
- planar configuration (attribute 0028,0006) = 0.

This format is used for Functional Imaging, i.e., images that meaningfully use all common CT Image attributes - however the pixel values do not represent a scaled Hounsfield value but a different value (depending on the type of image). Thus, window related attributes must not be used to interpret the pixel values as scaled HU. The values used by Biograph mCT are:

- window center (attribute 0028, 1050) = 128
- window width (attribute 0028,1051) = 256

- rescale intercept (attribute 0028, 1050) = 0
- rescale slope (attribute 0028,1051) = 1

The following types of images may use this format:

Table 157: Image Type (0008,0008) for objects created by Biograph mCT

Image Type Description	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text
Averaged Image	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 AVE	none	AVE
Parameter Image (Patlak Blood Volume)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKBV	PAR
Parameter Image (Peak enhancement)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKET	PAR
Parameter Image (Perfusion Blood Flow)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PBF	PAR
Parameter Image (Perfusion Blood Volume)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PBV	PAR
Parameter Image (Permeability)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PMB	PAR
Parameter Image (Time to Peak)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	TTP	PAR
Parameter Image (Time to Start)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	TTS	PAR
Parameter Image (Patlak Residual)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKER	PAR
Parameter Image (Patlak RSquare)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKR2	PAR
Parameter Image (Arterial Liver Perfusion)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	ALP	PAR
Parameter Image (Portal Venous Liver Perfusion)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PVP	PAR
Parameter Image (Hepatic Perfusion Index)	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	HPI	PAR
LungCARE send-to-Filming images	CT	DERIVED	SECONDARY	OTHER	CSA MIP THIN	LC VALID WINDOW	MIP

Image Type Description	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text
LungCARE send-to-Filming images	CT	DERIVED	SECONDARY	OTHER	CSA MPR THICK	LC VALID WINDOW	MPR
LungCARE send-to-Filming images	CT	DERIVED	SECONDARY	OTHER	CSA VRT THIN	LC VALID WINDOW	VRT
LungCARE send-to-Filming images	CT	DERIVED	SECONDARY	OTHER	CSA PRVT	LC VALID WINDOW	PVRT
LungCARE send-to-Filming images	CT	DERIVED	SECONDARY	OTHER	CSA MPR	LC VALID WINDOW	MPR

8.5.1.2 Standard Extended Attributes for PET Image IOD

Table 158. Standard Extended Attributes for PET Image IOD

Name	Tag		Explanation		
Procedure Code Sequence	(0008,1032)		Used for Siemens internal processing		
>Code Value	(0008,0100)		Used for Siemens internal processing		
>Coding Scheme Designator	(0008,0102)		Used for Siemens internal processing		
>Code Meaning	(0008,0104)		Used for Siemens internal processing		
Performed Protocol Code Sequence	(0040,0260)		Used for Siemens internal processing		
>Code Value	(0008,0100)		Used for Siemens internal processing		
>Coding Scheme Designator	(0008,0102)		Used for Siemens internal processing		
>Code Meaning	(0008,0104)		Used for Siemens internal processing		

8.5.1.3 PET Extensions for non-Image Objects

Biograph mCT uses the following defined terms for Image Type (0008,0008):

- Value 1: ORIGINAL, DERIVED
- Value 2: PRIMARY
- Value 3: PET_CALIBRATION, PETCT_SPL, PET_LISTMODE, PET_EM_SINOGRAM, PET_PHYSIO, PET_REPLAY_PARAM, PET_COUNTRATE
- Value 4: CARDIAC, RESPIRATORY, PET_PHYSIO_MFL

The following table lists the Biograph mCT non-image types and the corresponding values.

Table 159: Biograph mCT non-image Types

Description	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4
Sinogram data	ORIGINAL	PRIMARY	PET_EM_SINOGRAM	none
Listmode data	ORIGINAL	PRIMARY	PET_LISTMODE	none or CARDIAC or RESPIRATORY
Attenuation correction data	DERIVED	PRIMARY	none	none
Norm data	ORIGINAL	PRIMARY	PET_CALIBRATION	none
Protocol data	ORIGINAL	PRIMARY	PETCT_SPL	none
Physiological data	ORIGINAL	PRIMARY	PET_PHYSIO	CARDIAC or RESPIRATORY Or PET_PHYSIO_MFL
Replay parameters	ORIGINAL	PRIMARY	PET_REPLAY_PARAM	none
Count Rate Data	ORIGINAL	PRIMARY	PET_COUNTRATE	none
PET TAC Data	ORIGINAL	PRIMARY	PET_TAC_IF	none

8.5.1.4 Extensions the Basic Directory for Siemens Non-Image Objects

According to the PRI-SYNGO Application Profile Class the usage of the Private Creator UIDs and further optional keys for the Directory Records referring to SIEMENS

Non-Image Objects are listed in the following table.

Attribute	Tag	Value used
Private Record UID	(0004,1432)	1.3.12.2.1107.5.9.1
SOP Class UID	(0008,0016)	1.3.12.2.1107.5.9.1

For the Non-Images no Icon Image Sequence will be generated

8.5.2 Specializations

8.5.2.1 Images Created by Biograph mCT

The following table lists the Biograph mCT image types and the corresponding combinations of the Image Type Attribute values.

Table 160: Image Type (0008,0008) for objects created by Biograph mCT

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
Averaged Image [Average, DynEva, Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 AVE	none	AVE
Interventional Cine Display Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 ICD	none	ICD
Monitoring Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 MON	none	MON
Premonitoring Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 MON	PMON	MON
Multiscan Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 MUL	none	MUL
Parameter Image (Arterial Liver Perfusion) [BodyPerfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	ALP	PAR
Parameter Image (Hepatic Perfusion Index) [BodyPerfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	HPI	PAR
Parameter Image (Portal Venous Liver Perfusion) [BodyPerfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PVP	PAR
Protocol Image, Time Density Curve Image [BodyPerfusion][23]	SC	DERIVED	SECONDARY	OTHER	none	none	AC
Parameter Image (Patlak Blood Volume) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKBV	PAR
Parameter Image (Patlak Residual) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKER	PAR
Parameter Image (Patlak RSquare) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKR2	PAR

[23] More detailed attribute information will be provided in a future version.

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
Parameter Image (Peak enhancement) [DynEva, Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PKET	PAR
Parameter Image (Perfusion Blood Flow) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PBF	PAR
Parameter Image (Perfusion Blood Volume) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PBV	PAR
Parameter Image (Permeability) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	PMB	PAR
Parameter Image (Time to Peak) [DynEva, Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	TTP	PAR
Parameter Image (Time to Start) [Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PAR	TTS	PAR
Protocol Image	SC	DERIVED	SECONDARY	OTHER	CT_SOM5 PROT	none	PROT (List only)
Report Image (not finished)	SC	DERIVED	SECONDARY	OTHER	CT_SOM5 REP	IN_WORK	REP
Report Image (finished)	SC	DERIVED	SECONDARY	OTHER	CT_SOM5 REP	FINISHED	REP
ROT Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 ROT	none	ROT
Real Time Display Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 RTD	none	RTD
Real Time Display Image (Cardio)	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 RTD	STD	RTD
Multiscan Real Time Display Image	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 RTD	MRTD	RTD
Sequence Image	CT	ORIGINAL	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SEQ	none	SEQ

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
Additional Scan Image	CT	ORIGINAL	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SEQ	ADD	SEQ
Control Scan Image	CT	ORIGINAL	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SEQ	CTL	SEQ
Spiral Image	CT	ORIGINAL	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SPI	none	SPI
Spiral Image (Cardio)	CT	ORIGINAL	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SPI	STD	SPI
Spiral Oblique Image	CT	DERIVED	PRIMARY / SECONDARY	AXIAL	CT_SOM5 SPO	none	SPO
Static Image	CT	ORIGINAL	PRIMARY	OTHER	CT_SOM5 STA	none	STA
Subtracted Image	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 SUB	none	SUB
Topogram	CT	ORIGINAL	PRIMARY	LOCALIZER	CT_SOM5 TOP	none	TOP
Osteo Scanned Tomogram	CT	ORIGINAL	PRIMARY	AXIAL	CT_SOM5 SEQ	OTOM	SEQ
Osteo Scanned Topogram	CT	ORIGINAL	PRIMARY	LOCALIZER	CT_SOM5 TOP	OTOP	TOP
Osteo Evaluated Tomogram	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 OEVA	none	OEVA
Pulmo Evaluated Tomogram	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 PEVI	none	PEVI
Calcium Scoring Table [Calcium Scoring]	SC	DERIVED	SECONDARY	OTHER	CT_SOM5 TAB	none	TAB
Dental Filming Image	CT	DERIVED	SECONDARY	OTHER	CT_SOM5 DFLM	none	DFLM
Dental Panorama Rebuild Tomogram	CT	DERIVED	SECONDARY	OTHER	CT_SOM5 DPAN	none	DPAN
Dental Paraxial Rebuild Tomogram	CT	DERIVED	SECONDARY	OTHER	CT_SOM5 DPAR	none	DPAR

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
Dental/Volume Maximum Intensity Projection Image [Dental, Volume, DynEva, Perfusion]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 MIP	none	MIP
Dental Panorama Reference Image [Dental, Volume]	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 MPR	none	MPR
Dental Paraxial Reference Image	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 MPR	none	MPR
Dental Reference Image	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 MPR	none	MPR
Dynamic Evaluation Averaged Baseline	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 DYB	none	DYB
Dynamic Evaluation Fused Multislice	CT	DERIVED	SECONDARY	AXIAL	CT_SOM5 DYF	none	DYF
Volume reformatted images (sagittal and coronal)	CT	DERIVED	SECONDARY	OTHER	CT_SOM5 MPR	none	MPR
Various result images [CalciumScoring, Colon]	CT	DERIVED	SECONDARY	AXIAL	CSA MPR	none	MPR
Various result images	CT	DERIVED	SECONDARY	AXIAL	CSA MPR THICK	none	MPR
Various result images	CT	DERIVED	SECONDARY	AXIAL	CSA MIP	none	MIP
Various result images [CalciumScoring]	CT	DERIVED	SECONDARY	AXIAL	CSA MIP THIN	none	MIP
Various result images [Colon]	SC	DERIVED	SECONDARY	OTHER	CSA PSSD	none	PSSD
Various result images	CT	DERIVED	SECONDARY	AXIAL	CSA VRT	none	VRT

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
Various result images [Colon]	SC	DERIVED	SECONDARY	OTHER	CSA VRT	none	VRT
InSpace bookmark [InSpace]	SC	DERIVED	SECONDARY	OTHER	CSA BOOKMARK	RT3D CONFIG	BOOK
InSpace result images [InSpace]	SC	DERIVED	SECONDARY	OTHER	CSA 3DPROJECTION	none	3DPR
LungCARE save images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	MIP	LC VALID WINDOW	MIP
LungCARE save images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	MPR	LC VALID WINDOW	MPR
LungCARE save images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	VRT	LC VALID WINDOW	VRT
LungCARE save images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	PVRT	LC VALID WINDOW	PVRT
LungCARE save images [LungCARE]	CT	DERIVED	SECONDARY	OTHER	MPR	LC VALID WINDOW	MPR
LungCARE save images [LungCARE]	CT	DERIVED	SECONDARY	OTHER	CT_SOM5 SPI	LC VALID WINDOW	SPI
LungCARE report images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	MIP	LC VALID WINDOW	none
LungCARE report images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	MPR	LC VALID WINDOW	none

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
LungCARE report images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	VRT	LC VALID WINDOW	none
LungCARE report images [LungCARE]	SC	DERIVED	SECONDARY	OTHER	PVRT	LC VALID WINDOW	none
Various Graphics [DynEva, Osteo, Pulmo, Volume, Perfusion, Argus]	SC	DERIVED	SECONDARY	OTHER	CSA BLACK IMAGE	none	none

Note
Some applications will create Structured Reports. However, when running in specific (service configured) settings outside of the system they will appear as a SC image, labelled as Type 3 "OTHER" and Type 4 "CSA REPORT". This private extension is not published in detail here because the intended use is real DICOM SR.
For Protocol Image, Some additional information about DOSE INFO is added into Application Header Sequence(0029,xx40) in VB40, detailed info about this Sequence see "Biograph mCT Attribute Interpretation" in Page 148.

8.5.2.2 Structured Reports created by Biograph mCT

The following table lists the Biograph mCT image types and the corresponding combinations of the Image Type Attribute values.

Table 161: Image Type (0008,0008) for DICOM SR objects created by Biograph mCT

Image Type Description [known creating applications]	IOD	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5	Image Text or Lists
LungCARE SR reports [LungCARE, Calcium Scoring, Circulation]	SR	ORIGINAL	PRIMARY	OTHER	CSA REPORT	none	none
CT Dose SR	SR	ORIGINAL	PRIMARY	OTHER	CSA REPORT	none	none

LungCARE, Calcium Scoring and Circulation create Comprehensive Structured Reports.
The following is valid for Calcium Scoring created Structured Reports:

CaScoring creates structured reports generally following the templates defined in DICOM supplement 97 “CT/MR Cardiovascular Analysis Report” (Version: 0.11; Working Draft). Some changes of these templates that could not be considered may occur until document is released as final version.

The following is valid for Circulation created Structured Reports:

Circulation creates structured reports generally following the DICOM template TID3900.

Somaris system create CT Dose Structured Reports as a default configuration for every patient when he/she finish measurement.(user can disable this function.)

CT Dose Report generally follows the templates defined in DICOM Standard “CT Radiation Dose”

The following is valid for CT Dose Structured Reports: CT Dose SR follows the DICOM template TID10011.

8.5.2.3 Somaris Attribute Interpretation

8.5.2.4 OGG, Overlays, High Bit

Graphics in Biograph mCT images are stored as Object Oriented Graphics (OOG) in private attributes (see 5.2.1.2.5). Non *syngo* based systems are not expected to interpret this information.

In order to allow display access to graphics information for DICOM based systems private OOG information is converted on export into DICOM Overlay information stored in group 6000. This is the recommended way for a DICOM based system to access overlay graphics information.

The following attributes are generated:

- Overlay Rows (6000,0010)
- Overlay Columns (6000,0011)
- Number of Frames in Overlay (6000,0015)
- Overlay Description (6000,0022) = "Siemens MedCom Object Graphics"
- Overlay Type (6000,0040) = "G"
- Origin (6000,0050) = 1, 1
- Image Frame Origin (6000,0051)
- Overlay Bits Allocated (6000,0100)
- Bit Position (6000,0102)
- Overlay Data (6000,3000)

However, DICOM Overlay information stored in group 6000 is not supported by all systems that might be used to store Biograph mCT images. These systems may not be able to display Biograph mCT generated overlays. For a special group of these systems there is another way to provide graphical overlay information. A remote node can be configured to have overlay graphics converted into unused pixel data above High Bit (0028,0102) for images that fulfil the following condition:

- bits allocated (attribute 0028, 0100) = 16
- bits stored (attribute 0028,0101) = 12
- high bit (attribute 0028,0102) = 11

Some systems are known to support this coding; they are able to display this information with the images. Please note, however, that the proper and recommended way to store overlays with DICOM is the use of group 6000.Privatizations

8.5.3 Private SOP Classes

8.5.3.1 Private SOP Class CSA Non-Image

This chapter includes the definition of the Siemens AG B Med CSA defined private Non-Image Object (called CsaNonImage IOD). The focus of this private Non-Image Object is to address the requirement for non-image data sets found in *syngo* based applications. The CSA Non-Image IOD uses the following SOP Class.

Table 162: SOP Class UID for CSA Non Image Objects

SOP Class Name	SOP Class UID
CSA Non-Image	1.3.12.2.1107.5.9.1

The MedCom Non-Image Information Object Definition specifies data sets that are converted from a non-DICOM format to a modality independent DICOM format.

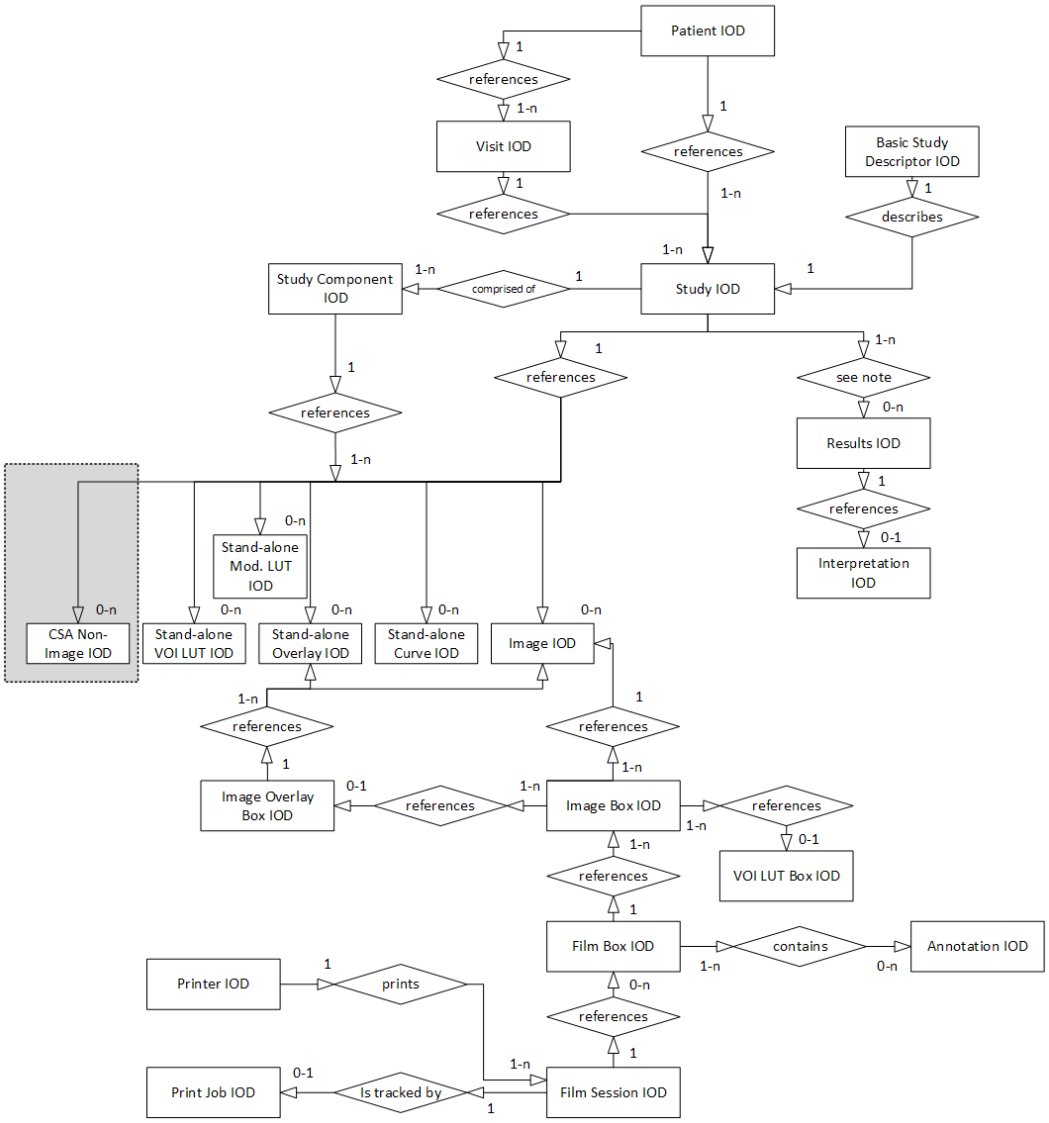
Examples of such manufacturer model dependent data sets are:

- Raw Data
- CT Admin Data
- MR Spectroscopy Data
- etc.

8.5.3.1.1 CSA Non-Image IOD Entity Relationship Model

The E-R model in [DICOM] A.1.2 depicts those components of the DICOM Information Model which directly refer to the CSA Non-Image IOD. The frame of reference IE, overlay IE, modality look up table IE, VOI lookup table IE and curve IE are not components of the CSA Non-Image IOD.

Figure 3 DICOM Information Model



8.5.3.1.2 CSA Non-Image IOD Module Table

Table 163: CSA Non-Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	[1] PS3.3 C.7.1.1	M
Study	General Study	[1] PS3.3 C.7.2.1	M
	Patient Study	[1] PS3.3 C.7.2.2	U
Series	General Series	[1] PS3.3 C.7.3.1	M
Equipment	General Equipment	[1] PS3.3 C.7.5.1	U
CSA	CSA Image Header	Table 128	U
	CSA Series Header	Table 129	U
	MEDCOM Header	Table 130	U
	CSA Non-Image	Table 164	M
	SOP Common	[1] PS3.3 C.12.1	M

8.5.3.1.3 CSA Non-Image Module

The table in this section contains private IOD Attributes that describe CSA Non-Images.

Table 164: CSA Non-Image Module

Attribute Name	Tag	Private Creator	Type	Notes
Image Type	(0008,0008)	-	3	Image identification characteristics. See 5.2.3.4.
Acquisition Date	(0008,0022)	-	3	The date the acquisition of data that resulted in this data set started.
Acquisition Time	(0008,0032)	-	3	The time the acquisition of data that resulted in this data set started.
Conversion Type	(0008,0064)	-	3	Describes the kind of image conversion. Defined Terms: DV = Digitized Video, DI = Digital Interface, DF = Digitized Film, WSD = Workstation.
Referenced Image Sequence	(0008,1140)	-	3	A sequence which provides reference to a set of Image SOP Class/Instance identifying other images significantly related to this data set. Encoded as sequence of items: (0008,1150) and (0008,1155).
Derivation Description	(0008,2111)	-	3	A text description of how this data set was derived.
Source Image Sequence	(0008,2112)	-	3	A Sequence which identifies the set of Image SOP Class/Instance pairs of the Images which were used to derive this data set. Zero or more Items may be included in this Sequence. Encoded as sequence of items: (0008,1150) and (0008,1155).
Patient Position	(0018,5100)	-	3	Patient position descriptor relative to the equipment.
Acquisition Number	(0020,0012)	-	3	A number identifying the gathering of data over a period of time which resulted in this data set.
Instance Number	(0020,0013)	-	3	A number that identifies this data set.
Frame of Reference UID	(0020,0052)	-	3	Uniquely identifies the frame of reference for a Series.
Image Comments	(0020,4000)	-	3	User-defined comments about the image.

Attribute Name	Tag	Private Creator	Type	Notes
Quality Control Image	(0028,0300)	-	3	Indicates whether or not this image is a quality control or phantom image. If this Attribute is absent, then the image may or may not be a quality control or phantom image. Enumerated Values: YES, NO.
Burned In Annotation	(0028,0301)	-	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. If this Attribute is absent, then the image may or may not contain burned in annotation. Enumerated Values: YES, NO.
Lossy Image Compression	(0028,2110)	-	3	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression, 01 = Image has been subjected to lossy compression.
Lossy Image Compression Ratio	(0028,2112)	-	3	Describes the approximate lossy compression ratio(s) that have been applied to this image. May be multi valued if successive lossy compression steps have been applied.
CSA Data Type	(0029,xx08)	SIEMENS CSA NON-IMAGE	1	CSA Data identification characteristics. Defined Terms: RAW DATA NUM 4 = NUMARIS/4 Raw Data SPEC NUM 4 = NUMARIS/4 Spectroscopy RAW DATA SOM 5 = Somaris/5 Raw Data RAW DATA SOM 7 = Somaris/7 Raw Data BSR REPORT = BSR Study Report Data COL REPORT SOM5 = syngo Colonography Report Data
CSA Data Version	(0029,xx09)	SIEMENS CSA NON-IMAGE	3	Version of CSA Data Info (0029,xx10) format and CSA Non-Image Data (7FE1,xx10) format.

Attribute Name	Tag	Private Creator	Type	Notes
CSA Data Info	(0029,xx10)	SIEMENS CSA NON-IMAGE	3	Information to describe the CSA Data (7FE1,xx10). The value of the attribute CSA Data Info (0029,xx10) can be build up in each user defined format.
CSA Data	(7FE1,xx10)	SIEMENS CSA NON-IMAGE	1	Binary data as byte stream.

8.5.3.1.4 CT Extensions of the Non-Image Object

Biograph mCT uses the following defined term for Image Type (0008,0008):

- Value 1: ORIGINAL
- Value 2: PRIMARY
- Value 3: AXIAL, LOCALIZER, OTHER
- Value4: a CT_SOM5 * enumeration
- Value5: Biograph mCT specific enumeration

The following table lists the Biograph mCT non-image types and the corresponding combinations of the Image Type Attribute values.

Table 165: (Non-)Image Type (0008,0008) for private Biograph mCT Non-image Objects

Description	0008,0008 Value 1	0008,0008 Value 2	0008,0008 Value 3	0008,0008 Value 4	0008,0008 Value 5
CAD Results	DERIVED	SECONDARY	OTHER	CAD MARKS	none
Colonography Data	DERIVED	SECONDARY	OTHER	CT_SOM5 COL	none
Coronary Tree	DERIVED	SECONDARY	OTHER	CT_CIRCULATION	none
Raw Data	Same entries as for images				

8.5.4 Private Transfer Syntaxes

N/A

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