

SIEMENS



DICOM Conformance Statement

Cios Alpha VA10

See the power with Full View FD

www.siemens.com/dicom

1 Conformance Statement Overview

The CIOS Alpha is a SIEMENS Imaging Modality based on FLUOROSPOT® Compact. The CIOS Alpha is designed to be integrated into an environment of medical, DICOM-based devices. The CIOS Alpha supports Storage and Transfer of images utilizing the DICOM "Storage Service Class", the display of data and retrieval of images from DICOM Archives utilizing the DICOM "Query/Retrieve Service Class". Workflow Management is supported by querying worklists from RIS and returning information about the procedure performed. Furthermore the Import from and export to DICOM CD/DVD media is supported. Printing of viewing results is provided with Print Management Services.

Table 1 - Network Services

| SOP Classes | User of Service (SCU) | Provider of Service (SCP) |
|--|-----------------------|---------------------------|
| Verification | | |
| Verification | Yes | Yes |
| Transfer (Image SOP Class) | | |
| Computed Radiography Image Storage | No | Yes |
| CT Image Storage | No | Yes |
| MR Image Storage | No | Yes |
| Multi-frame Grayscale Byte Secondary Capture Image Storage | No | Yes |
| Multi-frame Grayscale Secondary Capture Image Storage | No | Yes |
| Secondary Capture Image Storage (as Exam Protocol) | Yes | Yes |
| Multi-frame True Color Secondary Capture Image Storage | Yes | Yes |
| X-Ray Angiographic Image Storage | Yes | Yes |
| X-Ray Radiofluoroscopic Image Storage | No | Yes |
| Digital X-Ray Image - For Presentation Image Storage | No | Yes |
| Ultrasound Image Storage | No | Yes |
| Ultrasound Multi-frame Image Storage | No | Yes |
| Transfer (Non-image SOP Class) | | |
| X-Ray Radiation Dose SR | Yes | No |
| Workflow Management | | |
| Modality Performed Procedure Step SOP Class | Yes | No |
| Modality Worklist Information Model - FIND | Yes | No |
| Storage Commitment Push Model SOP Class | Yes | No |
| Query/Retrieve | | |
| Study Root Q/R - Information Model - FIND | Yes | No |
| Study Root Q/R - Information Model - MOVE | Yes | No |
| Print Management | | |
| Basic Grayscale Print Management Meta | Yes | No |
| Presentation LUT | Yes (for Grayscale) | No |

Table 2 - Media Services

| Media Storage Application Profile | Write Files (FSC or FSU) | Read Files (FSR) |
|---|--------------------------|------------------|
| Compact Disk - Recordable | | |
| General Purpose CD-R interchange | Yes (see Note 1) | Yes |
| DVD | | |
| General Purpose Interchange on DVD-RAM Media | Yes(see Note 1) | Yes |
| USB | | |
| General Purpose USB Media Interchange with JPEG | Yes (see Note 1) | Yes |

Note 1: with uncompressed setting

Table 3 - Implementation Identifying Information

| Name | Value |
|-----------------------------|------------------------|
| Application Context Name | 1.2.840.100008.3.1.1.1 |
| Implementation Class UID | 1.3.12.2.1107.5.3.4 |
| Implementation Version Name | " Siemens_FLC_70" |

2 Table of Contents

| | | |
|----------|---|-----------|
| 1 | <i>Conformance Statement Overview</i> | 2 |
| 2 | <i>Table of Contents</i> | 4 |
| 3 | <i>Introduction</i> | 6 |
| 3.1 | Revision History | 6 |
| 3.2 | Audience | 6 |
| 3.3 | Remarks | 6 |
| 3.4 | Definitions, Terms and Abbreviations | 6 |
| 3.5 | References | 7 |
| 4 | <i>Networking</i> | 8 |
| 4.1 | Implementation Model | 8 |
| 4.1.1 | Application Data Flow | 8 |
| 4.1.2 | Functional Definitions of Application Entities | 11 |
| 4.1.3 | Sequencing of Activities | 12 |
| 4.2 | Application Entity Specification | 13 |
| 4.2.1 | Verification SCU AE Specification | 13 |
| 4.2.2 | Storage SCU AE Specification | 15 |
| 4.2.3 | Storage SCP AE Specification..... | 19 |
| 4.2.4 | Query/Retrieve SCU Specification..... | 22 |
| 4.2.5 | Print SCU Specification | 26 |
| 4.2.6 | Worklist SCU AE..... | 32 |
| 4.2.7 | Modality PPS SCU AE..... | 38 |
| 4.3 | Network Interfaces | 43 |
| 4.3.1 | Physical Network Interface | 43 |
| 4.3.2 | Additional Protocols | 43 |
| 4.4 | Configuration | 43 |
| 4.4.1 | AE Title/Presentation Address Mapping | 43 |
| 4.4.2 | Parameters | 44 |
| 5 | <i>Application Profile Conformance Statement</i> | 45 |
| 5.1 | Implementation Model | 45 |
| 5.1.1 | Application Data Flow Diagram | 45 |
| 5.1.2 | Functional Definitions of AEs..... | 45 |
| 5.1.3 | Activities..... | 46 |
| 5.1.4 | Implementation Identifying Information..... | 46 |
| 5.2 | AE Specifications | 47 |
| 5.2.1 | DICOM Archive Specification | 47 |
| 5.3 | Augmented and Private Application Profiles | 48 |
| 5.4 | Media Configuration | 49 |
| 5.4.1 | Single- / Multi-Session CD burning..... | 49 |
| 5.4.2 | “Viewer on CD” | 49 |
| 5.4.3 | Auto-Labeling..... | 49 |
| 6 | <i>Support of Extended Character Sets</i> | 50 |
| 7 | <i>Security</i> | 50 |

| | | |
|------------|--|-----------|
| 8 | <i>Annexes</i> | 51 |
| 8.1 | IOD Contents | 51 |
| 8.1.1 | Created SOP Instances | 51 |
| 8.1.2 | Usage of attributes from received IODs | 59 |
| 8.1.3 | Attribute mapping..... | 59 |
| 8.2 | Coded Terminology and Templates | 60 |
| 8.3 | Grayscale Image Consistency | 60 |
| 8.4 | Standard Extended/Specialized/Private SOP Classes | 61 |
| 8.4.1 | Standard Extended XA | 61 |
| 8.5 | Private Transfer Syntaxes | 62 |
| | <i>Annex A: Index of Tables</i> | 63 |

3 Introduction

3.1 Revision History

n.a.

3.2 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.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between CIOS Alpha 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 CIOS Alpha 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 reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens representative for the most recent product information.

3.4 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 |
| CSE | Customer Service Engineer |
| DB | Database |
| DCS | DICOM Conformance Statement |
| DICOM | Digital Imaging and Communications in Medicine |
| 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 |
| MPPS | Modality Performed Procedure Step |
| <i>n. a.</i> | not applicable |
| NEMA | National Electrical Manufacturers Association |
| 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 |
| SPS | Scheduled Procedure Step |
| SR | Structured Report |
| TFT | Thin Film Transistor (Display) |
| TID | Template ID |
| U | Unique Key Attribute |
| UID | Unique Identifier |
| UTF-8 | Unicode Transformation Format-8 |
| VR | Value Representation |

3.5 References

[1] Digital Imaging and Communications in Medicine (DICOM) Standard, available free at <http://medical.nema.org/>, NEMA PS 3^a

• ^a The DICOM Standard is under continuous maintenance, the current official version is available at <http://dicom.nema.org>

4 Networking

4.1 Implementation Model

- **Verification**
The CIOS Alpha DICOM Service Tool application requests Verification to proof the ability of a remote DICOM application to respond to DICOM messages. Responding to Verification requests from remote nodes is handled by the Storage SCP.
- **Storage**
The CIOS Alpha DICOM implementation is able to initiate associations for Storage of DICOM Composite Information Objects to Remote AEs and to receive and respond to associations for Storage from Remote AEs.
- **Storage Commitment**
The CIOS Alpha DICOM implementation is able to initiate requests for Storage Commitment Push (for previously sent DICOM Composite Information Objects) to Remote AEs.
- **Query/Retrieve**
The CIOS Alpha DICOM application supports the Query/Retrieve services as SCU to retrieve IODs to the local database.
- **Print**
The CIOS Alpha DICOM implementation is able to initiate associations as Print Management SCU for printing of composed film-sheets with one or more DICOM Print AE.
- **Workflow**
The CIOS Alpha will issue automated “broad” worklist queries and interactive “narrow” worklist queries as DICOM Modality Worklist SCU. The status of the procedure started and performed is communicated via MPPS, which is also supported in SCU role only. Radiation Dose information is also sent via MPPS.

4.1.1 Application Data Flow

The division of CIOS Alpha into the separate DICOM Application Entities represents a somewhat arbitrary partitioning of functionality. For the purpose of this document they are organized in this manner to detail their independent logical functionality.

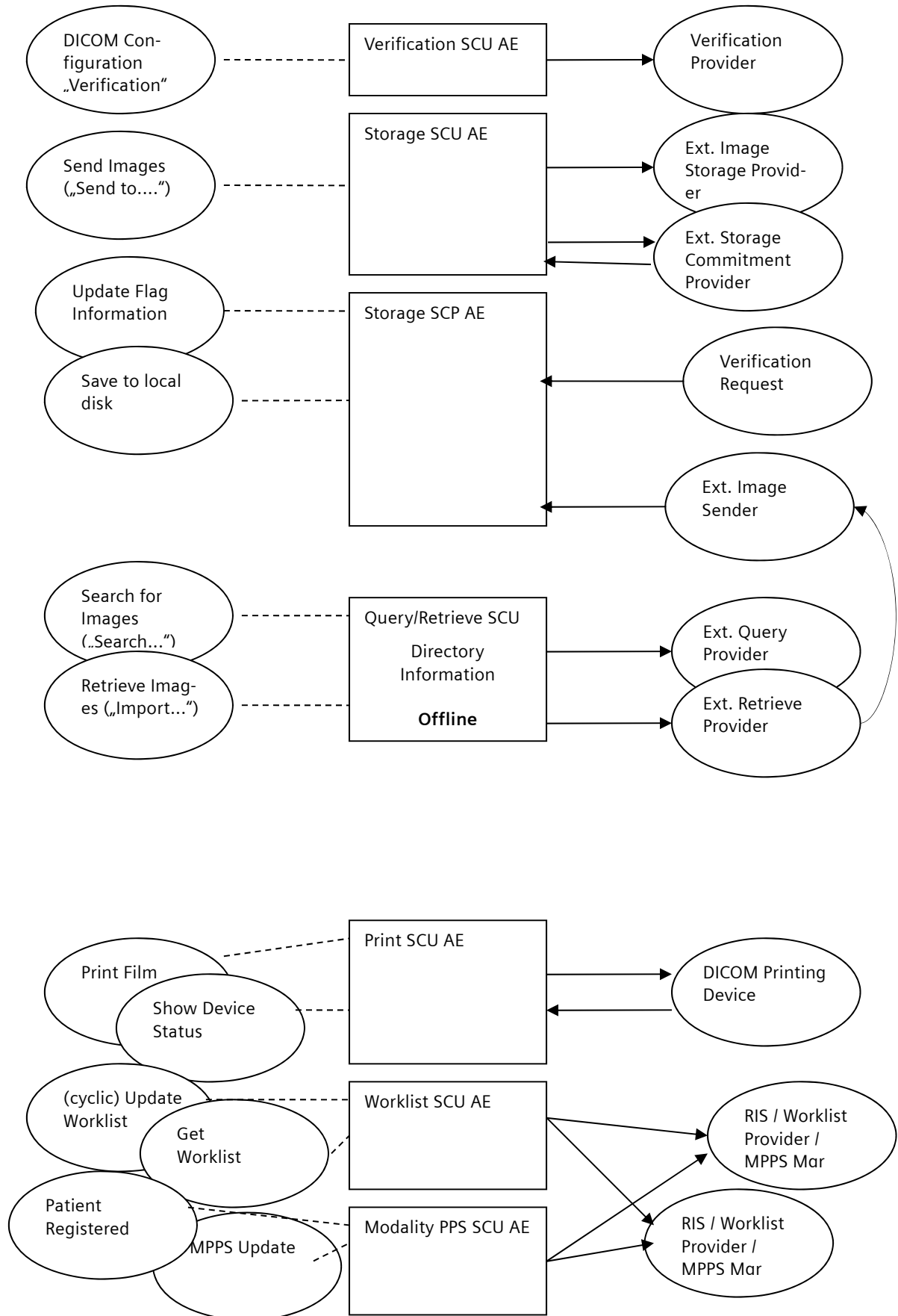


Table 4 - CIOS Alpha DICOM Data Flow Diagram

- The CIOS Alpha DICOM Service Tool application opens an association when a "verification" of a remote application is requested during a configuration session. This can be done when entering new data to configure a remote application or to verify existing configuration data.
- The Storage SCU AE can send Composite SOP Instances and automatically request Storage Commitment for sent SOP Instances, if configured and handles incoming commitment status N-EVENT messages.
- The Storage SCP AE can receive incoming DICOM images and add them to the local database. It can respond to external Storage and Verification Requests as a Service Class Provider (SCP) for C-ECHO and C-STORE requests. Last mentioned requests are only handled in combination with Query/Retrieve.
The Storage SCP AE supports Composite SOP Instances as indicated in Chapter ["Conformance Statement Overview"](#).
- The Query part of the Query/Retrieve SCU AE uses C-FIND to search a DICOM Database for Patient Study and Series information.
The Retrieve part of the Query/Retrieve SCU AE uses C-MOVE to initiate a DICOM transfer of composite objects to the local database.
- The Print SCU sends film-sheets with n images to the printer. The printer status is monitored by sending Status requests.
- The Worklist SCU AE runs autonomously for cyclic "broad" query and issues C-FIND Worklist model requests. It can be manually triggered for most recent data. A "broad" query with user input can be triggered separately.
- The MPPS AE uses N-CREATE when first radiation exposure is released for a patient and updates via N-SET when closing the examination (triggers "final N-SET").

4.1.2 Functional Definitions of Application Entities

4.1.2.1 Functional Definition of Verification-SCU AE

The CIOS Alpha DICOM Service Tool application opens an association when a "verification" of a remote application is requested during a configuration session. This can be done when entering new data for remote application configuration or to verify existing configuration data.

4.1.2.2 Functional Definition of Storage-SCU AE

The CIOS Alpha Storage SCU is invoked by the job control interface that is responsible for processing network archival 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.

With each successfully completed send job, the CIOS Alpha DICOM Application will populate the Storage Commitment Push Model Action Information from the SOP Instances sent. Then a Storage Commit Request is triggered, if configured. Depending on configuration, the CIOS Alpha 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 related 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" (Job-status is "waiting") for a configurable time (default: 1h). If the "open time" for a pending commitment request has elapsed w/o a related response from the provider, the Transaction UID is removed and the related entities are indicated as "commit failed".

Open Transaction UIDs of pending commitment requests are discarded after a reboot of the system. The related entities are indicated as "commit failed".

4.1.2.3 Functional Definition of Storage-SCP AE

The Storage SCP component of the CIOS Alpha DICOM application is operating as background server process. The process starts when the system is triggered to import images and waits then 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.

The Verification SCP is included in the Storage SCP.

4.1.2.4 Functional Definition of Query/Retrieve-SCU AE

The CIOS Alpha DICOM 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 system's user interface. Depending on user action (Import) the CIOS Alpha Query/Retrieve DICOM SCU sends a C-MOVE DIMSE service to initiate a C-STORE sub-operation on the SCP to start an image transfer from remote Storage SCU (running on Query/Retrieve SCP) to the system's Storage SCP.

4.1.2.5 Functional Definition of Print SCU AE

The Print SCU is invoked by the user interface to setup film-sheet layout and whenever an 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.

4.1.2.6 Functional Definition of Worklist SCU AE

The worklist SCU ("broad query") is invoked from the patient mode or by timer to request the worklist from a remote Information System (Modality Worklist Class SCP). The worklist SCP responses to the C-FIND query and scheduled imaging service requests (scheduled procedure steps) and patient demographic information will be "pulled" from the information system to the CIOS Alpha 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 mode allows entering specific matching criteria ("narrow query") for the worklist query. With the response data the Patient Registration dialog can be populated according availability within the worklist response identifier.

4.1.2.7 Functional Definition of Modality PPS SCU AE

With first radiation exposure for a registered Patient (i.e. a Scheduled Procedure Step from Worklist), the CIOS Alpha DICOM application will create an MPPS Instance and communicate it to the MPPS Manager (SCP). The status of MPPS is set to "Completed" when the patient is closed.

For unscheduled patients no MPPS message is sent.

4.1.3 Sequencing of Activities

4.1.3.1 Verification

Newly entered data have to be saved first, before a "verification" of these data is possible.

4.1.3.2 Storage

Prior to sending of SOP Instances the CIOS Alpha Storage application is capable of invoking processing and resizing features in order to prepare image pixel contents into convenient formats for certain multi-vendor environments.

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

4.1.3.3 Query/Retrieve

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

The Query application will not "per se" request information on SERIES level. The user can select a study and request series level information with the "Series List" function.

4.1.3.4 Workflow

The "narrow" (interactive) 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.

An MPPS N-CREATE message is sent when radiation is exposed for a patient. For procedure steps registered as "emergency" cases no MPPS N-CREATE is sent.

4.2 Application Entity Specification

4.2.1 Verification SCU AE Specification

4.2.1.1 SOP Classes

For SOP Classes supported, please refer to "Table 1 - Network Services" section "Verification" in the ["Conformance Statement Overview"](#).

4.2.1.2 Association Policies

4.2.1.2.1 General

The CIOS Alpha DICOM Service Tool application attempts to open an association for verification request whenever the "C-Echo" Button is activated in network diagnostics for configured AETs.

4.2.1.2.2 Number of Associations

The CIOS Alpha DICOM Service Tool application initiates one association at a time to request verification.

4.2.1.2.3 Asynchronous Nature

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

4.2.1.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in the ["Conformance Statement Overview"](#).

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – "Verification"

4.2.1.3.1.1 Description and Sequencing of Activity

The Verification SCU C-ECHO request is initiated by Service and Diagnostic SW whenever "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.

4.2.1.3.1.2 Proposed Presentation Contexts

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

Table 5 - Presentation Context Table "Verification"

| Presentation Context Table – "Verification" | | | | | |
|---|-------------------|---------------------------|---------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | SCU | None |
| | | Implicit VR Little Endian | 1.2.840.10008.1.2 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |

4.2.1.3.1.3 SOP Specific Conformance – Verification SCU

The Application conforms to the definition of the Verification SCU in accordance to the DICOM Standard.

4.2.1.4 Association Acceptance Policy

The Verification SCP is part of the Storage SCP.

4.2.2 Storage SCU AE Specification

4.2.2.1 SOP Classes

For SOP Classes supported, please refer to “Table 1 - Network Services”, sections “Transfer” and “Workflow Management”.

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM Storage application will be triggered by the transfer job queue. An association request is sent to the destination AE and, upon successful negotiation of a Presentation Context, the transfer is started. Depending on configuration, processing or resizing can be applied to the images prior to being sent.

With a Send Job successfully completed, the DICOM application will generate the Storage Commitment Action Information (if configured) which references to all Instances of the processed job. The Commit Request is sent over a single opened association. The CIOS Alpha 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 a time-stamp, is kept. Depending on configuration, the association is closed or kept open for a configured time range. If the association is closed immediately, the response is expected on a different association which is the default setting. Multiple Storage Commitment Requests can be pending.

The default PDU size used will be 64KB.

4.2.2.2.2 Number of Associations

The CIOS Alpha DICOM application initiates one associations at a time.

4.2.2.2.3 Asynchronous Nature

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

4.2.2.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3 - Implementation Identifying Information” in the [“Conformance Statement Overview”](#).

4.2.2.3 Association Initiation Policy

If a job with network destination gets active in the job list or a retrieve sub-operation is processed, the CIOS Alpha DICOM application attempts to initiate a new association for

- DIMSE C-STORE to send images and with successful status and
- N-ACTION DIMSE for the Storage Commitment Push Model Service Class to request commitment.

4.2.2.3.1 Activity – “Send to ...”

4.2.2.3.1.1 Description and Sequencing of Activity

The C-STORE request is triggered by a export job with network destination. If the process successfully establishes an association to a remote Application Entity, it will transfer each image one after another via the open association. Processing features and resizing of the pixel matrix can be applied as part of the transfer. If the C-STORE Response from the remote Application contains a status other than “Success” or “Warning”, the association is aborted.

With success status for the previous transfer, the CIOS Alpha Storage application sends, if storage Commitment is configured, the commit request (N-ACTION-RQ) message and waits for ac-

ceptance of this request (N-ACTION-RSP). After receiving this, the transaction is marked as "waiting".

The association will be closed after a maximum of 10 seconds. After that receiving the storage commitment status is expected on a different association. If the commit response (N-EVENT-REPORT) does not arrive within the configured time-out, the transaction will be marked as failed.

4.2.2.3.1.2 Proposed Presentation Contexts

The CIOS Alpha DICOM application will propose Storage SCU Presentation Contexts as shown in the following table:

Table 6 - Presentation Context Table "Send to ..."

| Presentation Context Table – "Send to ..." | | | | |
|---|--|---|------|-----------|
| Abstract Syntax | Transfer Syntax | | Role | Ext. Neg. |
| Description | Name List | UID List | | |
| Any image SOP Class detailed in "Table 1 - Network Services" section „Transfer (Image SOP Class) “. | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCU | None |
| Any Non-image SOP Class detailed in "Table 1 - Network Services" section „Transfer (Non-image SOP Class) “. | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCU | None |
| Storage Commitment SOP Class as detailed in "Table 1 - Network Services" section "Workflow Management". | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCU | None |

4.2.2.3.1.3 SOP specific Conformance - "Send to ..."

The CIOS Alpha can send images in different formats. In a user and destination specific service level configuration it can be configured whether images are sent original or resized.

For association and DIMSE level time-outs, please refer to section [Configuration](#) (4.4.2 Parameters) of this document.

4.2.2.3.1.3.1 *Optional Attributes*

Please refer to the related Image Object definition tables in the Annex (section "[Created SOP Instances](#)") for a list of all DICOM IOD attributes of type 2 and 3, which are encoded by the CIOS Alpha applications.

4.2.2.3.1.3.2 *Specialized Information Object Definitions*

The DICOM images sent by CIOS Alpha 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.

The DICOM nodes are responsible for data consistency when modifying images. All unknown private attributes have to be removed upon modification!

4.2.2.3.1.3.3 *Data Dictionary of applied private IOD Attributes*

Please refer to "[Standard Extended/Specialized/Private SOP Classes](#)" in the Annex for a list of possible private IOD attributes.

4.2.2.3.1.4 SOP specific Conformance - Request Commitment

Storage Commitment is supported for all the SOP Classes detailed in Chapter "Table 1 - Network Services" section "Workflow Management".

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.

4.2.2.4 Association Acceptance Policy

4.2.2.4.1 Activity – Update Flag Information

4.2.2.4.1.1 Description and Sequencing of Activity

After sending a Storage Commitment Request the CIOS Alpha either waits on the same association or, being configured to receive response on a separate association, closes the association and waits for an association request from the Storage Commitment SCP that wants to send the results.

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 related Instances are marked with the reported status. The over-all Commit Status of the higher Information Entities in the CIOS Alpha database is derived from propagation of the States of all sub-ordinate Image entities included in a study.

The Status Flags directly affected by Storage Commitment results and indicated in the different entities of the Patient previous list can be one of

- The flag chars S/s show, that all/some images are sent to a DICOM workstation and also committed, in case the DICOM destination is working with Storage Commitment.
- The flag chars A/a show that all/some images are sent to a DICOM workstation tagged as "Archive" and also committed, in case the "Archive" is working with Storage Commitment.

4.2.2.4.1.2 SOP specific Conformance

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 CIOS Alpha DICOM application will not support the Storage Media File Set ID attributes.

4.2.3 Storage SCP AE Specification

4.2.3.1 SOP Classes

For SOP Classes supported, please refer to “Table 1 - Network Services” Sections “Transfer” on page 1.

4.2.3.2 Association Policies

4.2.3.2.1 General

The CIOS Alpha DICOM application will accept any number of verification or storage SOP classes that are referred to above. There is no limit on the number of presentation contexts accepted except for the DICOM limit. In the event that the Siemens DICOM application runs out of resources, it will reject the association request.

CIOS Alpha will only accept Associations from known hosts with a known AET. Hosts and AETs have to be entered in "Local Service" by a Siemens CSE.

The default PDU size used will be 64 KB.

4.2.3.2.2 Number of Associations

The Siemens CIOS Alpha DICOM application accepts one association at a time.

4.2.3.2.3 Asynchronous Nature

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

4.2.3.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3 - Implementation Identifying Information” in the [“Conformance Statement Overview”](#).

4.2.3.3 Association Acceptance Policy

The CIOS Alpha DICOM application attempts to accept a new association for

- DIMSE C-ECHO for incoming Verification requests
- DIMSE C-STORE for external image senders request storage of instances
- DIMSE N-EVENT-REPORT for receiving commitment result from a previous request

4.2.3.3.1 Activity – Save to local disk

4.2.3.3.1.1 Description and Sequencing of Activity

The CIOS Alpha DICOM application will accept an association and will receive SOP Instances according to the listed presentation contexts on that association and will store the images to the local hard disk if the conformance check is performed successfully.

Receiving is possible whenever an import request (C-MOVE) is sent to a remote destination. As long as it is active, the receiver process will accept an association and will receive images transmitted on that association and will store the images on disk in the own data base if the conformance check is performed successfully.

Upon successful receiving a C-STORE-RQ, the CIOS Alpha DICOM receiver performs a 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:

Table 9 - Status Codes "Save to local disk"

| Service Status | Meaning | Error Codes (0000.0900) |
|----------------|--|-------------------------|
| Failure | Refused: This error status indicates a lack of Resources (e.g. not enough disk space) on the CIOS Alpha modality. | A700 |
| | Invalid Dataset: An error occurred while processing the image, which makes it impossible to proceed. The image will not be stored and the association is aborted. | A900 C000 |
| Success | Successful | 0000 |

4.2.3.3.1.2 Accepted Presentation Context

The CIOS Alpha DICOM application will accept Presentation Contexts as shown in the following table:

Table 7 - Presentation Context Table "Save to local disk"

| Presentation Context Table – "Save to local disk" | | | | |
|---|--|---|------|-----------|
| Abstract Syntax | Transfer Syntax | | Role | Ext. Neg. |
| Description | Name List | UID List | | |
| Any image SOP Class detailed in "Table 1 - Network Services" section „Transfer (Image SOP Class) “. | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCP | None |
| Any non-image SOP Class detailed in "Table 1 - Network Services" section „Transfer (Non-image SOP Class) “. | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCP | None |

4.2.3.3.1.3 SOP specific Conformance

The CIOS Alpha application conforms to the Full Storage Service Class at Level 1.

Any Explicit VR Transfer Syntax is preferred to be used by the Storage SCU when sending Composite Image Instances to the CIOS Alpha DICOM application.

The following sections will differentiate the attribute contents required for Image Viewing.

Image Pixel Attribute Acceptance Criterion for Grayscale Images

The CIOS Alpha Viewing application accepts pixel data with unsigned integer and 8 or 16 bits allocated.

Accepted values:

Pixel plane

- Samples per Pixel (0028,0002) = 1
- Photometric Interpretation (0028,0004) = "MONOCHROME2" + "RGB"
- Only Pixel Aspect Ratio (0028.0034) 1:1 is supported
- Pixel Representation (attribute 0028,0103) = 0
- Bits Allocated (0028,0100) = 8, 16
- Bits Stored (0028,0101) = 8, 10, 12, 16
- High Bit (0028,0102) = 7, 9, 11, 15

Following restrictions are valid:

- For VOI LUT, only the linear LUT (Window Center/Width) and not the VOI LUT Sequence is supported.
- Display of overlay planes is not supported.
- No manipulations except windowing are allowed on imported images
- Multiframe objects with identical image type are expected to be separated in series level.

4.2.4 Query/Retrieve SCU Specification

4.2.4.1 SOP Classes

For SOP Classes supported, please refer to "Table 1 - Network Services" section „Query/Retrieve“ in the [“Conformance Statement Overview”](#).

4.2.4.2 Association Policies

4.2.4.2.1 General

With the "Query/Retrieve..." function the query data can be entered and the DICOM Query/Retrieve application is initiated. A query request will be sent out to one remote node that can be selected from a list of configured Query Providers. The results compiled from the response data will be displayed to the user. Upon request (Import), the retrieval of selected items is initiated.

The default PDU size used will be 64KB.

4.2.4.2.2 Number of Associations

The CIOS Alpha DICOM application initiates one association for each query request.

For Query it initiates a new association to the remote node and issues the C-FIND request to retrieve all the requested patient and study information matching the search criteria. For the Retrieve request (C-MOVE) only one association is initiated per destination.

4.2.4.2.3 Asynchronous Nature

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

4.2.4.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in the [“Conformance Statement Overview”](#).

4.2.4.3 Association Initiation Policy

The CIOS Alpha DICOM application will request associations for the following DIMSE-C operations as SCU:

Table 8 - Supported DIMSE-C Operations - Query/Retrieve SCU

| Supported DIMSE operations |
|----------------------------|
| C-FIND |
| C-MOVE |

Extended negotiation (relational query) is not supported for the above listed services.

4.2.4.3.1 Activity – Search for images (Search...)

4.2.4.3.1.1 Description and Sequencing of Activity

The associated activity is to fill out a query form with search data and pass it as query 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. If needed, further associations are opened for querying data from sub-subsequent entities. When data transfer is finished, each association is closed.

If the C-FIND Response from the remote Application contains an error status, the association is aborted.

4.2.4.3.1.2 Proposed Presentation Contexts

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

Table 9 - Presentation Context Table "Search..."

| Presentation Context Table - "Search..." | | | | | |
|--|-----------------------------|--|---|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Study Root Query/Retrieve Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1 | SCU | None |

4.2.4.3.1.3 SOP Specific Conformance

The CIOS Alpha DICOM Query/Retrieve SCU supports hierarchical queries with all mandatory search keys. The interactive querying of attributes on IMAGE level is not supported by the Query SCU; hence retrieval of individual images is not possible. The following table describes the search keys for the different query models that the SCU supports. Matching is either wildcard, which means that the user can supply a string containing wildcards, or universal, which means that the attribute is requested as return value.

Table 10 - C-FIND RQ Search Keys

| Attribute Name | Tag | Type | Matching | User Input | Return Value Display |
|------------------------------------|-------------|-------|----------------------------------|-------------|----------------------|
| Patient Study Level | | | | | |
| Patient Name | (0010,0010) | R | Wildcard ^b | Enter value | yes |
| Patient ID | (0010,0020) | U / R | Wildcard | Enter value | yes |
| Patient's Birth Date | (0010,0030) | O | Single value | Enter value | yes |
| Patient's Sex | (0010,0040) | O | Single value | Enter value | yes |
| Study Instance UID | (0020,000D) | U | Universal(Null)/ Single value | -- | yes |
| Study ID | (0020,0010) | R | Wildcard | Enter value | yes |
| Study Date | (0008,0020) | R | Universal(Null) | -- | yes |
| Study Time | (0008,0030) | R | Universal(Null) | -- | yes |
| Accession Number | (0008,0050) | R | Wildcard | Enter value | yes |
| Study Description | (0008,1030) | O | Universal(Null) | -- | yes |
| Number of Study related Series | (0020,1206) | O | Universal(Null) | -- | yes |
| Number of Study related Instances | (0020,1208) | O | Universal(Null) | -- | yes |
| Series Level | | | | | |
| Series Instance UID | (0020,000E) | U | Universal(Null) | -- | yes |
| Series Number | (0020,0011) | R | Universal(Null) | -- | yes |
| Modality | (0008,0060) | R | Universal(Null) | -- | yes |
| Series Description | (0008,103E) | O | Universal(Null) | -- | yes |
| Number of Series related Instances | (0020,1209) | | Universal(Null) | -- | yes |

U = Unique Key, **R** = Required Key, **O** = Optional Key, - = not supported or applicable

The CIOS Alpha Search application supports a

- DIMSE C-CANCEL

If the user wishes to cancel a running Query request via the CIOS Alpha user interface ("Cancel" button while a "Search..." is active).

^b Always a "*" is appended to the user-supplied string

The Find SCU interprets following status codes:

Table 11 - Status Codes "Search..."

| Service Status | Meaning | Error Codes | Related Fields |
|----------------|--|-------------|----------------------------|
| Refused | Out of Resources | A700 | (0000,0902) |
| Failed | 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 |

4.2.4.3.2 Activity – Retrieve Studies (Import...)

4.2.4.3.2.1 Description and Sequencing of Activity

When selecting a data entry in the Query UI and activating the "Import" function, a retrieval request is passed to the CIOS Alpha DICOM application which issues a C-MOVE service according to the Study Root query model. (The Storage Service Class Conformance Statement describes the C-STORE service, which is generated by processing the C-MOVE service.)

The received image data are processed as described in the Storage class SCP descriptions.

The CIOS Alpha DICOM application will always insert the own Storage SCP AE as "Move Destination".

4.2.4.3.2.2 Proposed Presentation Contexts

The CIOS Alpha Server DICOM application will propose Presentation Contexts as shown in the following table:

Table 12 - Presentation Context Table "Import..."

| Presentation Context Table | | | | | |
|--|-----------------------------|---------------------------|---------------------|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Query/Retrieve Model Study Root – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

4.2.4.3.2.3 SOP Specific Conformance

All required keys will be provided in the retrieve request identifier, as defined in DICOM Standard.

The Move SCU interprets following status codes:

Table 13 - C-MOVE RSP Status Codes

| Service Status | Meaning | Error Codes | Related Fields |
|----------------|--|-------------|--|
| Refused | Out of Resources - Unable to calculate number of matches | A701 | (0000,0902) |
| | Out of Resources - Unable to perform sub operations | A702 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |
| | Unknown Destination | A801 | n.a. |
| Failed | 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) |
| Success | Sub-operations Complete - No Failures or Warning | 0000 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |
| Pending | Sub-operations are continuing | FF00 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |

4.2.4.1 Association Acceptance Policy

n.a.

4.2.5 Print SCU Specification

4.2.5.1 SOP Classes

For SOP Classes supported, please refer to "Table 1 - Network Services" section "Print Management" in the ["Conformance Statement Overview"](#).

4.2.5.2 Association Policies

4.2.5.2.1 General

Whenever a film-sheet is completely set up and printed by command or automated rule, the job is prepared for processing. As soon as the queue is ready to process the job, it is activated and worked according to the processing data. The Print application will initiate an association to the print destination and process the printing.

The default PDU size used will be 64KB.

4.2.5.2.2 Number of Associations

The CIOS Alpha DICOM application initiates one association at a time for each different print device configured.

4.2.5.2.3 Asynchronous Nature

The CIOS Alpha DICOM print application does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.5.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to "Table 3 - Implementation Identifying Information" in the ["Conformance Statement Overview"](#).

4.2.5.3 Association Initiation Policy

Triggered by the Print job queue the Print Management SCU establishes an association by using the DICOM association services. An N-GET request determines the printer status prior to printing. If the printer status is "normal", the print job is started.

4.2.5.3.1 Activity - Print Film

4.2.5.3.1.1 Description and Sequencing of Activity

Depending on the film sheet layout all corresponding images are sent via Image Box SOP Class.

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

4.2.5.3.1.2 Proposed Presentation Context

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

Table 14 - Presentation Context Table "Print Film"

| Presentation Context Table | | | | | |
|---|-----------------------|---------------------------|---------------------|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.1.9 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| Basic Film Session SOP Class | 1.2.840.10008.5.1.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

| | | | | | |
|-------------------------------------|------------------------|--|---|-----|------|
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| Basic Film Box SOP Class | 1.2.840.10008.5.1.1.2 | Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 | SCU | None |
| Basic Grayscale Image Box SOP Class | 1.2.840.10008.5.1.1.4 | Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 | SCU | None |
| Printer SOP Class | 1.2.840.10008.5.1.1.16 | Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 | SCU | None |
| Presentation LUT SOP Class | 1.2.840.10008.5.1.1.23 | Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 | SCU | None |

4.2.5.3.1.3 SOP Specific Conformance

The CIOS Alpha DICOM print management SCU conforms to the DICOM Basic Grayscale 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 copiers supported film sizes of the connected DICOM SCP
- supported film formats of the DICOM SCP

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

Basic Film Session SOP Class

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

The CIOS Alpha DICOM print management SCU 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 the following attributes:

Table 15 - Basic Film Session N-CREATE attributes

| Attribute Name | Tag | Usage SCU | Supported Values |
|------------------|-------------|-----------|------------------|
| Number of Copies | (2000,0010) | U | Set by user |
| Print Priority | (2000,0020) | U | MED |

U = User Option

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 Session – see below:

| 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 remove 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 16 - Basic Film Session Status Codes

| Service Status | Meaning | Error Codes |
|----------------|---|-------------|
| Failure | Unable to create print job, print queue is full | C601 |
| | Image size is larger than images box size | C603 |
| Warning | Requested MinDensity or MaxDensity outside of Printer's operating range | B605 |
| | Film box does not contain image box (empty page) | B602 |
| Success | Film belonging to the film session are accepted for printing | 0000 |

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 Service Elements as SCU are:

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

The Basic Film Box SOP Class N-CREATE-RQ message uses the following attributes (the actual values for each attribute depend on DICOM printer configuration within the CIOS Alpha DICOM print management SCU):

Table 17 - Basic Film Box N-CREATE attributes

| Attribute Name | Tag | Usage SCU | Supported Values |
|----------------------------------|-------------|-----------|--|
| Image Display Format | (2010,0010) | M | STANDARD\n,n set by user |
| Referenced Film Session Sequence | (2010,0500) | M | n. a. |
| > 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) | UM | (from Camera configuration) PORTRAIT or LANDSCAPE |
| Film Size ID | (2010,0050) | U | (from Camera configuration) 8INX10IN, 10INX12IN, 11INX14IN, 4INX14IN, 14INX17IN |

M = Mandatory, **U** = User Option

The N-CREATE-RSP message from the Print SCP includes the Referenced Image Box Sequence with SOP Class/Instance UID pairs which will be kept internally and 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 DICOM print manager will issue a N-ACTION-RQ message with the SOP Instance UID of the Basic Film Box 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 - see below:

| 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 18 - Basic Film Box Status Codes

| Service Status | Meaning | Error Codes |
|----------------|---|-------------|
| Failure | Unable to create print job, print queue is full | C601 |
| | Image size is larger than images 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 |

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 Grayscale 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 19 - Basic Grayscale Image Box N-SET attributes

| Attribute Name | Tag | Usage SCU | Supported Values |
|--------------------------------|-------------|-----------|-----------------------------|
| Image Position | (2020,0010) | M | Depending on display format |
| BASIC Grayscale Image Sequence | (2020,0110) | M | n.a. |
| > Samples per Pixel | (0028,0002) | M | 1 |
| > Photometric Interpretation | (0028,0004) | M | MONOCHROME2 |
| > Rows | (0028,0010) | M | <Printer/Film config> |
| > Columns | (0028,0011) | M | <Printer/Film config> |
| > Pixel Aspect Ratio | (0028,0034) | M | 1\1 |
| > 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 | |

M = Mandatory

The Grayscale Image Box SOP Class interprets the following status codes:

Table 20 - Basic Grayscale Image Box Status Codes

| Service Status | Meaning | Error 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 |

Presentation LUT SOP Class

The Presentation LUT tailors image hardcopy printing 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.

The Presentation LUT SOP Class uses only the N-CREATE-RQ with the following attributes:

Table 21 - Presentation LUT N-CREATE attribute

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

U = User Option

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:

| 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 22 - Presentation LUT Status Codes

| Service Status | Meaning | Codes |
|----------------|--|-------|
| Success | Presentation LUT successfully created | 0000 |
| Warning | Requested MinDensity or MaxDensity outside of printer's operating range. The printer will use its respective minimum or maximum density value instead. | B605 |

Printer SOP Class

The Printer SOP Class allows monitoring 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.

The following returned information is supported:

Table 23 - Used Printer N-EVENT Report attributes

| 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 |

U = User Option

Table 24 - 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 tables in Annex for details. |

M = Mandatory

4.2.5.3.1.4 SOP Specific Conformance

The Printer SOP Class allows monitoring the status of the hardcopy printer in a synchronous and an asynchronous way.

The Print SCU AE application will cyclically “ask” the Printer (SCP) for its status synchronously:

- N-GET as SCU

The following information is supported:

Table 25 - Used Printer N-EVENT Report attributes

| 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 |

U = User Option

<modify If detailed status displays of the DICOM Print SCU are described in the Annex, add a reference to the Annex section below

Table 26 - 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 tables in Annex for details. |

M = Mandatory

4.2.5.4 Association Acceptance Policy

n. a.

4.2.6 Worklist SCU AE

4.2.6.1 SOP Classes

For SOP Classes supported, please refer to “Table 1 - Network Services” section „Workflow Management“ in the [“Conformance Statement Overview”](#).

4.2.6.2 Association Policies

4.2.6.2.1 General

It is possible to configure a cyclic update of the modality Worklist 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 Worklist. Entries are uniquely identified by the Study Instance UID (0020,000D) for the Requested Procedure. An interactive worklist query can be issued with search criteria entered in the patient based Query dialog from the patient mode.

The default PDU size used will be 64KB.

4.2.6.2.2 Number of Associations

The CIOS Alpha DICOM application initiates one association at a time to query worklist entry data.

4.2.6.2.3 Asynchronous Nature

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

4.2.6.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3 - Implementation Identifying Information” in the [“Conformance Statement Overview”](#).

4.2.6.3 Association Initiation Policy

The CIOS Alpha DICOM application will cyclically query the worklist provider and by request from the patient registration interface. It establishes an association by using the

- C-FIND with Worklist information model

It is possible to configure multiple worklist providers but only one can be active at a time. The active worklist provider can be selected in the service.

4.2.6.3.1 Activity - (cyclic) Update Worklist

4.2.6.3.1.1 Description and Sequencing of Activity

A network application will perform worklist queries with the C-FIND request at regular intervals. In addition it can be triggered by immediate request. All worklist data from previous queries will be deleted when new data is received.

No automatic clean-up of the Worklist is performed after a Patient-based Query since the worklist received - due to restricted search criteria - does not correspond to the list of all currently scheduled procedures for the modality.

4.2.6.3.1.2 Proposed Presentation Context

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

Table 27 - Presentation Context "Update Worklist"

| Presentation Context Table – "Update Flag Information" | | | | | |
|---|--|---|-----|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Description | Name List | UID List | | | |
| 1.2.840.10008.5.1.4.31 Modality Worklist Information Model - FIND | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCU | None | |

4.2.6.3.1.3 SOP Specific Conformance

- Search Key Attributes for the Worklist C-FIND

The CIOS Alpha DICOM worklist SCU supports "broad worklist queries" with all required search keys. The following table describes the "broad query" search keys that the SCU supports.

Table 28 - Supported Broad Worklist Query Search Key Attributes

| Attribute Name | Tag | Matching Key Type | Query Value |
|---|-------------|-------------------|--|
| Scheduled Procedure Step | | | |
| Scheduled Procedure Step Sequence | (0040,0100) | R | |
| >Scheduled Station AE Title <i>(It depends on service settings whether the "own AET" is provided or not.)</i> | (0040,0001) | R | <own AET> or <zero length> |
| >Schedule Procedure Step Start Date <i>(It depends on service settings whether the actual Date with a full time range or an interactive input dialog for date/time specification is used.)</i> | (0040,0002) | R | <act. Date>-<act. Date> or range from UI |
| >Schedule Procedure Step Start Time <i>(It depends on service settings whether the actual Date with a full time range or an interactive input dialog for date/time specification is used.)</i> | (0040,0003) | R | 00.00-235959.00 or range from UI |
| >Modality <i>(It depends on service settings whether the "own Modality" is provided or not.)</i> | (0008,0060) | R | <zero length> or <own Modality> |

R = Required

- Return Key Attributes of the Worklist C-FIND

The CIOS Alpha DICOM Worklist SCU supports worklist queries with return key attributes of all types. The following table describes the return keys that the SCU supports.

Table 29 - Basic Worklist C-FIND-RSP Return Key Attributes

| Module Name Attribute Name | Tag | M | R | Q | UI | IOD |
|---|-------------|---|---|---|----|----------------|
| SOP Common Specific Character Set | (0008,0005) | | x | | | x |
| Scheduled Procedure Step Scheduled Procedure Step Sequence | (0040,0100) | | x | | | |
| > Scheduled Station AET | (0040,0001) | S | | | | |
| > Scheduled Procedure Step Start Date | (0040,0002) | S | | | | |
| > Scheduled Procedure Step Start Time | (0040,0003) | S | | | | |
| > Modality | (0008,0060) | S | | | | |
| > Scheduled Performing Physician's Name | (0040,0006) | | x | x | x | x ¹ |
| > Scheduled Procedure Step Description | (0040,0007) | | x | | | x |
| > Scheduled Protocol Code Sequence | (0040,0008) | | x | | | x |

| Module Name Attribute Name | Tag | M | R | Q | UI | IOD |
|---|-------------|---|---|---|----|----------------|
| >> Code Value | (0008,0100) | | x | | | x |
| >> Coding Scheme Designator | (0008,0102) | | x | | | x |
| >> Coding Scheme Version | (0008,0103) | | x | | | x |
| >> Code Meaning | (0008,0104) | | x | | | x |
| > Scheduled Procedure Step Location | (0040,0011) | | x | | | |
| > Pre-Medication | (0040,0012) | | x | | | |
| > Scheduled Procedure Step ID | (0040,0009) | | x | | | x |
| > Scheduled Procedure Step Status | (0040,0020) | | x | | | |
| > Requested Contrast Agent | (0032,1070) | | x | | | |
| Requested Procedure | | | | | | |
| Requested Procedure ID | (0040,1001) | | x | x | x | x ² |
| Requested Procedure Description | (0032,1060) | | x | | x | x ³ |
| Requested Procedure Code Sequence | (0032,1064) | | x | | | x ⁴ |
| > Code Value | (0008,0100) | | x | | | x ⁴ |
| > Coding Scheme Designator | (0008,0102) | | x | | | x ⁴ |
| > Coding Scheme Version | (0008,0103) | | x | | | x ⁴ |
| > Code Meaning | (0008,0104) | | x | | | x ⁴ |
| Study Instance UID | (0020,000D) | | x | | | x |
| Referenced Study Sequence | (0008,1110) | | x | | | x |
| > Referenced SOP Class UID | (0008,1150) | | x | | | x |
| > Referenced SOP Instance UID | (0008,1155) | | x | | | x |
| Requested Procedure Priority | (0040,1003) | | x | | | |
| Names of Intended Recipients of Results | (0040,1010) | | x | | | |
| Requested Procedure Comments | (0040,1400) | | x | | | |
| Imaging Service Request | | | | | | |
| Accession Number | (0008,0050) | | x | x | x | x |
| Requesting Physician | (0032,1032) | | x | | x | |
| Referring Physician's Name | (0008,0090) | | x | x | x | x |
| Requesting Service | (0032,1033) | | x | | | |
| Imaging Service Request Comments | (0040,2400) | | x | | | |
| Visit Identification | | | | | | |
| Institution Name | (0008,0080) | | x | | x | x |
| Admission ID | (0038,0010) | | x | | | |
| Visit Status | | | | | | |
| Current Patient Location | (0038,0300) | | x | x | | x |
| Visit Admission | | | | | | |
| Admitting Diagnoses Description | (0008,1080) | | x | | | x |
| Visit Relationship | | | | | | |
| Referenced Patient Sequence | (0008,1120) | | x | | x | x |
| > Referenced SOP Class UID | (0008,1150) | | x | | x | x |
| > Referenced SOP Instance UID | (0008,1155) | | x | | x | x |
| Patient Identification | | | | | | |
| Patient Name | (0010,0010) | | x | x | x | x |
| Patient ID | (0010,0020) | | x | x | x | x |
| Other Patient Ids | (0010,1000) | | x | | | x |
| Other Patient Names | (0010,1001) | | x | | | x |
| Patient Demographic | | | | | | |
| Patient's Birth Date | (0010,0030) | | x | | x | x ⁵ |
| Patient's Sex | (0010,0040) | | x | | x | x |
| Patient's Weight | (0010,1030) | | x | | x | x |
| Patient's Size | (0010,1020) | | x | | x | x |
| Patient's Address | (0010,1040) | | x | | | |
| Military Rank | (0010,1080) | | x | | x | x |
| Ethnic Group | (0010,2160) | | x | | | x |
| Patient Comments | (0010,4000) | | x | | | x |
| Confidentiality Constraints on Patient Data | (0040,3001) | | x | | | x |
| Patient Medical | | | | | | |

| Module Name Attribute Name | Tag | M | R | Q | UI | IOD |
|-------------------------------|-------------|---|---|---|----|-----|
| Patient State | (0038,0500) | | x | | | |
| Patient Weight | (0010,1030) | | x | | | x |
| Pregnancy Status | (0010,21C0) | | x | | | |
| Medical Alerts | (0010,2000) | | x | | | |
| Contrast Allergies | (0010,2110) | | x | | | |
| Special Needs | (0038,0050) | | x | | | |
| Smoking Status | (0010,21A0) | | x | | | |
| Additional Patient History | (0010,21B0) | | x | | | x |
| Last Menstrual Date | (0010,21D0) | | x | | | |

The table should be read as follows:

- Attribute Name:** Attributes supported to build a Worklist Request Identifier.
- Return Key Type:** Mandatory, conditional and optional Return key.
- Tag:** Appropriate DICOM tag for this attribute.
- M:** Matching keys for Worklist Update. A "S" will indicate that this attribute contains a value for Single Value Matching. It can be configured that the attribute is used as Return Key only
- R:** Return keys. A "x" will indicate that this attribute is a Return Key with zero length for Universal Matching.
- Q:** Interactive Query Key. A "x" will indicate that this attribute is a matching key, if entered in the Query Patient Worklist dialog. The other keys will then be Return Keys only.
- UI:** An "x" in the **UI** column will indicate the attribute is displayed in the user interface. The display is influenced by the related configuration. All return values are visible by selecting the patient and pressing right mouse button.
- IOD:** An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

The default Query Configuration is set to "Modality" and "Date". Optionally, matching for the own "AE Title" and "Date" is configurable. For "Date" one of the following settings could be configured: "Today", "Yesterday – Today", "Today +/- 12 hours", "Today +/- 24 hours", and "Use no Date".

In Patient based worklist update, the usage of date and time can be deactivated! The Scheduled AE Title is used as Return Key only.

x¹ : "Scheduled Performing Physician's Name (0040,0006)" is not directly included in the header. However, its value is stored in the header as "Performing Physician's Name (0008,1050)". It can be modified by user during Patient Registration.

x² : Requested Procedure ID (0040,1001) is directly included in the header in the requested attribute sequence. Additionally, its value is stored in the header as Study ID (0020,0010). Study ID can be modified by the user during Patient Registration.

x³ : Requested Procedure Description (0032,1060) is not directly included in the header. However, its value is stored in the header as "Study Description (0008,1030)". It can be modified by user during Patient Registration.

x⁴: Requested Procedure Code Sequence (0032,1064) is not directly included in the header. However, its value is stored in the header as "Procedure Code Sequence (0008,1032)". It is not sent, when the scheduled protocol codes differ from the performed protocol codes.

x⁵: If a date of birth (0010,0030) with zero_length value is received via worklist, the date of birth will internally set to 1850/01/01.
The value 1850/01/01 for the date of birth is not used in a DICOM header (DICOM Send, MPPS, CD/DVD Export), but again replaced by zero length.

- The Worklist SCU interprets the following status codes:

Table 30 - Status Codes "Update Worklist"

| Service Status | Meaning | Error Codes | Related Fields |
|----------------|--|-------------|----------------------------|
| Refused | Out of Resources | A700 | (0000,0902) |
| Failed | 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 |

4.2.6.3.2 Activity - Get Worklist

4.2.6.3.2.1 Description and Sequencing of Activity

With "Get Worklist" in the patient based Worklist Query dialog, the entered attributes are used to form a worklist request identifier. The response data is used to fill the Patient Registration dialog. The response data and only the response data is placed in the Worklist.

4.2.6.3.2.2 Proposed Presentation Context

This Activity will propose the same Presentation Context as with "Update Worklist". Please see related table in section 4.2.6.3.1.2.

4.2.6.3.2.3 SOP Specific Conformance

The CIOS Alpha DICOM worklist SCU supports "narrow worklist queries" with all required search keys. The following tables describe the "narrow query" search keys that the SCU supports.

Table 31 - Patient based "narrow query" Search Key Attributes

| Attribute Name | Tag | Matching Key Type | Query Value |
|--|-------------|-------------------|--------------------------------|
| Scheduled Procedure Step | | | |
| Scheduled Procedure Step Sequence | (0040,0100) | R | |
| >Modality | (0008,0060) | R | Input from UI or <zero length> |
| >Scheduled Performing Physician's Name | (0040,0006) | R | Input from UI or <zero length> |
| Requested Procedure | | | |
| Requested Procedure ID | (0040,1001) | R | Input from UI or <zero length> |
| Imaging Service Request | | | |
| Accession Number | (0008,0050) | R | Input from UI or |

| Attribute Name | Tag | Matching Key Type | Query Value |
|----------------------------|-------------|-------------------|-----------------------------------|
| | | | <zero length> |
| Referring Physician's Name | (0008,0090) | R | Input from UI or <zero length> |
| Patient Identification | | | |
| Patient's Name | (0010,0010) | R | Input from UI or <zero length> |
| Patient ID | (0010,0020) | R | Input from UI or <zero length> |

R = Required Key, **O** = Optional Key

The Return Key Attribute handling and supported Status Codes are identical to the "Update Worklist" activity. Please see 4.2.6.3.1.3 for details.

4.2.6.4 Association Acceptance Policy

n. a.

4.2.7 Modality PPS SCU AE

4.2.7.1 SOP Classes

For SOP Classes supported, please refer to “Table 1 - Network Services” section „Workflow Management“ in the [“Conformance Statement Overview”](#).

4.2.7.2 Association Policies

4.2.7.2.1 General

The creation of MPPS Instance is done automatically by CIOS Alpha whenever the first dose is applied to a non-emergency patient.

The default PDU size used will be 64KB.

4.2.7.2.2 Number of Associations

The CIOS Alpha DICOM application initiates one association at a time to create or set the MPPS instance.

4.2.7.2.3 Asynchronous Nature

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

4.2.7.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3 - Implementation Identifying Information” in the [“Conformance Statement Overview”](#).

4.2.8 Association Initiation Policy

The CIOS Alpha DICOM application will notify a RIS (MPPS Manager) about the status of a procedure while it is performed. It establishes an association by using the

- 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.

It is possible to configure multiple MPPS providers but only one can be active at a time. The active MPPS provider can be configured via Service-UI.

4.2.8.1.1 Activity - Patient registered

4.2.8.1.1.1 Description and Sequencing of Activity

A patient is registered by the Patient Registration “Exam” action. From this event the trigger to create a MPPS Instance is derived. The related Instance is then communicated to the configured RIS system when the first radiation is exposed. An association is established and the MPPS Instance is sent.

4.2.8.1.1.2 Proposed Presentation Context

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

Table 32 - Presentation Context “Patient Registered”

| Presentation Context Table – “Update Flag Information” | | | | |
|--|--|---|------|-----------|
| Abstract Syntax | Transfer Syntax | | Role | Ext. Neg. |
| Description | Name List | UID List | | |
| 1.2.840.10008.3.1.2.3.3 Modality Performed Procedure Step | Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian | 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 | SCU | None |

4.2.8.1.1.3 SOP Specific Conformance

- Attributes for the Performed procedure Step N-CREATE
The Siemens CIOS Alpha DICOM Modality Performed Procedure Step SCU informs the remote SCP when the examination of a scheduled procedure step is performed. The N-CREATE message is sent when the first radiation was exposed for a registered patient. The following table describes the supported attributes of a N-CREATE message.

Table 33 - Performed Procedure Step N-CREATE Attributes

| Attribute Name | Tag | 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 |
| >Requested Procedure ID | (0040,1001) | 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> |

| Attribute Name | Tag | Type | Value |
|---|-------------|------|--|
| >>Code Value | (0008,0100) | 1C | |
| >>Coding Scheme Designator | (0008,0102) | 1C | |
| >>Coding Scheme Version | (0008,0103) | 3 | |
| >>Code Meaning | (0008,0104) | 3 | |
| >Names of Intended Recipients of Result | (0040,1010) | 1 | from MWL or created |
| >Requested Procedure Comments | (0040,1400) | 2 | from MWL or <zero length> |
| Patient's Name | (0010,0010) | 2 | from MWL or user input |
| Patient ID | (0010,0020) | 2 | from MWL or user input |
| Patient's 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 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 End Date | (0040,0250) | 2 | <zero length> |
| Performed Procedure Step End Time | (0040,0251) | 2 | <zero length> |
| Performed Procedure Step Status | (0040,0252) | 1 | "IN PROGRESS" |
| Performed Procedure Step ID | (0040,0253) | 1 | From SPS ID or created |
| 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 | |
| >Coding Scheme Designator | (0008,0102) | 1C | |
| >Coding Scheme Version | (0008,0103) | 3 | |
| >Code Meaning | (0008,0104) | 3 | |
| Performed Procedure Step Discontinuation Reason Code Sequence | (0040,0281) | 3 | |
| Image Acquisition Results | | | |
| Modality | (0008,0060) | 1 | XA |
| Study ID | (0020,0010) | 2 | from Requested Procedure ID or created |
| Performed Protocol Code Sequence | (0040,0260) | 2 | from Scheduled Protocol Code Sequence or <zero length> |
| >Code Value | (0008,0100) | 1C | |
| >Coding Scheme Designator | (0008,0102) | 1C | |
| >Coding Scheme Version | (0008,0103) | 3 | |
| >Code Meaning | (0008,0104) | 3 | |
| Performed Series Sequence | (0040,0340) | 2 | <zero length> |
| Radiation Dose | | | |
| Distance Source to Detector | (0018,1110) | 3 | <zero length> |
| Image and Fluoroscopy Area Dose Product | (0018,115E) | 3 | <zero length> |
| Total Time of Fluoroscopy | (0040,0300) | 3 | <zero length> |
| Total Number of Exposures | (0040,0301) | 3 | <zero length> |
| Distance Source to Entrance | (0040,0306) | 3 | <zero length> |
| Exposure Dose Sequence | (0040,030E) | 3 | <zero length> |

| Attribute Name | Tag | Type | Value |
|---|-------------|------|---------------|
| Comments on Radiation Dose | (0040,0310) | 3 | <zero length> |
| Entrance Dose in mGy | (0040,8302) | 3 | <zero length> |
| Comments on Radiation Dose | (0040,0310) | 3 | <zero length> |
| Billing and Material Management Code | | | |
| Billing Procedure Step Sequence | (0040,0320) | 3 | <zero length> |
| Film Consumption Sequence | (0040,0321) | 3 | <zero length> |

- The Performed Procedure Step SCU interprets only following N-CREATE status codes as Warning or Success.

Table 34 - Status Codes "Patient Registered"

| Service Status | Meaning | Error Codes (0000.0900) |
|----------------|------------------------------|-------------------------|
| Warning | Attribute List Error | 0107 |
| | Attribute Value out of Range | 0116 |
| Success | MPPS Instance created | 0000 |

4.2.8.1.2 Activity - MPPS Complete

4.2.8.1.2.1 Description and Sequencing of Activity

At the end of examination the status of the MPPS Instance is set to "COMPLETED".

4.2.8.1.2.2 Proposed Presentation Context

For "MPPS Complete" the same Presentation Contexts as with "Patient registered" are proposed. Please see related table in section 4.2.8.1.1.2.

4.2.8.1.2.3 SOP Specific Conformance

- Attributes for the Performed procedure Step N-SET
The Siemens CIOS Alpha DICOM Modality Performed Procedure Step SCU informs the remote SCP about the performed examination and its status. The N-SET message is sent per finished examination (finished status "COMPLETED"). The following table describes the supported attributes of a N-SET message.

Table 35 - Performed Procedure Step N-SET Attributes

| Attribute Name | Tag | Type | Value |
|---|-------------|------|---------------------------------------|
| Performed Procedure Step Information | | | |
| Performed Procedure Step End Date | (0040,0250) | 1 | created |
| Performed Procedure Step End Time | (0040,0251) | 1 | created |
| Performed Procedure Step Status | (0040,0252) | 3 | "COMPLETED" |
| Performed Procedure Step Description | (0040,0254) | 3 | from SPS Description or user input |
| Performed Procedure Type Description | (0040,0255) | 2 | <zero length> |
| Procedure Code Sequence | (0008,1032) | 3 | from Requested Procedure |
| >Code Value | (0008,0100) | 1C | |
| >Coding Scheme Designator | (0008,0102) | 1C | |
| >Coding Scheme Version | (0008,0103) | 3 | |
| >Code Meaning | (0008,0104) | 3 | |
| Image Acquisition Results | | | |
| Performed Protocol Code Sequence | (0040,0260) | 3 | from Scheduled Protocol Code Sequence |
| >Code Value | (0008,0100) | 1C | |
| >Coding Scheme Designator | (0008,0102) | 1C | |
| >Coding Scheme Version | (0008,0103) | 3 | |
| >Code Meaning | (0008,0104) | 3 | |
| Performed Series Sequence | (0040,0340) | 1 | |

| Attribute Name | Tag | Type | Value |
|--|-------------|------|---|
| >Performing Physician's Name | (0008,1050) | 2C | from MWL or user input |
| >Protocol Name | (0018,1030) | 1C | from related SOP Instance |
| >Operator's Name | (0008,1070) | 2C | user input |
| >Series Instance UID | (0020,000E) | 1C | from related SOP Instance |
| >Series Description | (0008,103E) | 2C | from related SOP Instance |
| >Retrieve AE Title | (0008,0054) | 2C | |
| >Referenced Image Sequence | (0008,1140) | 2C | Series related SOP Instances as items |
| >>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 Time of Fluoroscopy | (0040,0300) | 3 | |
| Total Number of Exposures | (0040,0301) | 3 | |
| Entrance Dose in mGy | (0040,8302) | 3 | accumulated over complete procedure step |
| Image and Fluoroscopy Area Dose Product | (0018,115E) | 3 | accumulated over complete procedure step (dGy*cm ²) |
| Exposure Dose Sequence | (0040,030E) | 3 | on item for each irradiation event (acquisition or fluoro) |
| >KVP | (0018,0060) | 3 | peak KV used for this event (KV) |
| >X-ray Tube Current in µA | (0018,8151) | 3 | tube current used for this event |
| >Exposure Time | (0018,1150) | 3 | time of x-ray in ms for this event |
| >Filter Type | (0018,1160) | 3 | Filter Type |
| Comments on Radiation Dose | (0040,0310) | 3 | additional acquisition specific information as text OGP dGy*cm ² kV mAs Filter |
| Billing and Material Management Code | | | |
| Film Consumption Sequence | (0040,0321) | 3 | |
| >Number of Films | (2100,0170) | 3 | |
| >Medium Type | (2000,0030) | 3 | |
| >Film Size ID | (2010,0050) | 3 | |

- The Performed Procedure Step SCU interprets only the following N-SET status codes as Success.

Table 36 - Status Codes "MPPS Update"

| Service Status | Meaning | Error Codes (0000.0900) |
|----------------|-------------------|-------------------------|
| Success | MPPS Instance set | 0000 |

- Performed Procedure Step ID without MPPS option
Handling of Performed Procedure Step ID in case
 - MPPS is not configured or
 - Unscheduled case

The attribute "Performed Procedure Step ID" (0040,0235) will be encoded based on Modality Type = XA and DateTime of the first acquired image. The "Performed Procedure Step ID" stays the same for all acquired or derived images as long as the patient is registered.

4.2.8.2 Association Acceptance Policy

n. a.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The DICOM Interface of the CIOS Alpha provides DICOM TCP/IP Network Communication Support and uses the TCP/IP protocol stack from the operating system. It uses the MergeCOM sub-routine library. All available Ethernet interfaces are supported.

4.3.2 Additional Protocols

not applicable

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

Local AE Titles

According to the DICOM Standard, the AET string can be up to 16 characters long and must not contain any extended characters, only 7-bit ASCII characters (excluding Control Characters).

Change of the default AE Titles chosen by the system can be performed in the Service UI under "FLC Service / Configuration / DICOM Local Settings" item - first page.

Table 37 - Default AET Characteristics

| Application Entity | Default AE Title | TCP/IP Port |
|--------------------|------------------|-------------|
| Storage SCU | FLC_STORE_SCU | - |
| Storage SCP | FLC_STORE_SCP | 104 (fixed) |
| Query/Retrieve SCU | FLC_STORE_SCU | - |
| Print SCU | FLC_STORE_SCU | - |
| Worklist SCU | FLC_WK_SCU | - |
| MPPS SCU | | - |

Remote AE Titles

For each remote AE the following data and capabilities can be configured:

Table 38 - Remote AE Configuration Items

| Remote AE configuration item | Comment |
|--|---|
| Host Name | As defined in the network domain. This has to be configured also for any DICOM AE that wishes to connect to SCP services of CIOS Alpha. |
| TCP/IP address | As defined in the network domain. This has to be configured also for any DICOM AE that wishes to connect to SCP services of CIOS Alpha. |
| Logical Name(Alias) | Name for the AE used in the user interfaces of the CIOS Alpha applications. |
| AE Title | AET, as provided by network administration |
| Port Number | Port Number, as provided by network administration |
| If Storage Service support is checked | |
| Archive Node | When checked, sending to remote AET will set status of a (rchived), else s (ent) is indicated. |
| StC node Server | Select a previously configured alias for Storage Commitment when sending DICOM objects to the configured AE. |

| | |
|---|--|
| If Storage Commitment Service support is checked | |
| Timeout for Result in same association | Timeout in seconds to wait at the open association. |
| If Modality Worklist Service support is checked | |
| No Default Character Set used in Query | Checkbox to activate the option, that no default character set shall be used for the query message. Default: Deactivated. |
| Query Waiting time | The time in sec (1-999) to wait for the C-FIND-RSP after sending the C-FIND-RQ (default 20 sec.) |
| Max Query Match Number | The maximum number of entries accepted in one worklist (default is 200) |
| Query Interval | The time between two C-FIND-RQ to the Hospital Information system (default is 60 min, minimum is 3 min, maximum is 1440 min i.e. 24 hours) |
| Time Range | User configuration: +/- n hours |

4.4.2 Parameters

Default system parameters are described in following table.

Table 39 - General parameter settings and timeouts

| Time-out Values | | | | |
|--|--------------------|-----------|-----------|---|
| Parameter | Default Value[sec] | Min [sec] | Max [sec] | Comment |
| Accepting/Rejecting an Association Request | 60 | 15 | 600 | Wait for an Association Request or wait for a Peer to shut down the Association |
| Association Open Request | 60 | 15 | 600 | Wait for a reply to an Association Accept Request |
| Association Close Request | 60 | 15 | 600 | Wait for a reply to an Association Release Request |
| Accepting a Message over Network | 60 | 15 | 600 | Wait for a Network Write to be accepted |
| Waiting for Data between TCP/IP Packets | 60 | 15 | 600 | Wait for Data between TCP/IP packets |
| Accept network connect | 15 | 15 | 600 | Wait for a Network Connect to be accepted |
| General Transfer Setting | | | | |
| Simultaneous DICOM associations | 10 | 1 | 10 | Number of simultaneous associations running. |
| Maximum PDU Size | 64kByte | 4kByte | 1MByte | Proposed PDU size, each selectable value is doubled from previous, starting with 4kB. Additionally for optimization for some networks 28kByte are provided. |

5 Application Profile Conformance Statement

For "Offline Media Application Profiles" please refer to Table 2 - Media Services " on page 1.

5.1 Implementation Model

5.1.1 Application Data Flow Diagram

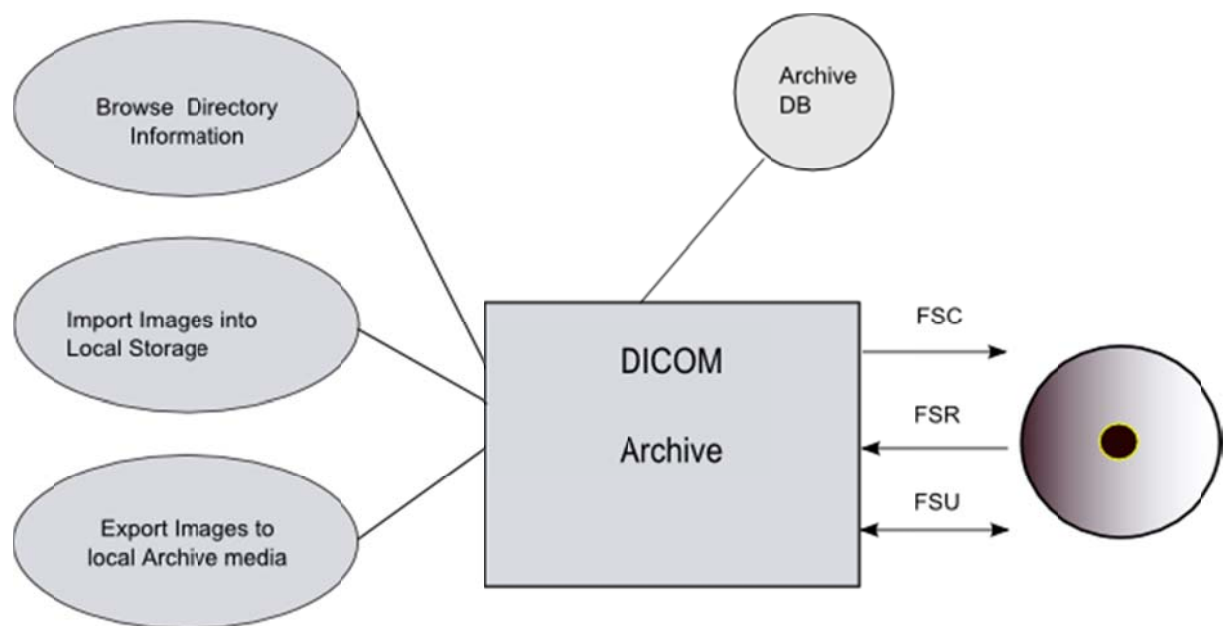


Table 40 - Application Data Flow DICOM Archive

The DICOM archive application will serve as an interface to the CD-R/DVD offline medium device.

The DICOM Archive application will support the 120mm CD-R and DVD medium.

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 temporarily be stored in Archive-Database.

5.1.2 Functional Definitions of AEs

The CIOS Alpha DICOM Offline Media Storage application consists of the DICOM Archive application entity serving all interfaces to access offline 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-sets DICOMDIR information into temporary database and pass it to display applications.

5.1.3 Activities

5.1.3.1 Description and Sequencing of Activity FSR

The DICOM Archive application will not perform transfers until the Directory information of the DICOMDIR is completely read in and displayed in the Browser.

5.1.4 Implementation Identifying Information

For Implementation Identifying Information please refer to “Table 3 - Implementation Identifying Information” in the [“Conformance Statement Overview”](#).

5.2 AE Specifications

5.2.1 DICOM Archive Specification

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

Details are listed in following Table:

Table 41 - Mapping of Application Profiles Supported

| Application Profiles Supported | Activity | Role | SC Option |
|--------------------------------|-------------------------------|----------|-------------|
| STD-GEN-CD STD-GEN-DVD | Browse Directory Information | FSR | Interchange |
| | Import into local Storage | FSR | Interchange |
| | Export to local Archive Media | FSC, FSU | Interchange |

5.2.1.1 File Meta Information for the Application Entity

5.2.1.2 Activities of DICOM Archive

5.2.1.2.1 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 those directory entries that are valid for the application profiles supported, into a temporary local database. The database can then be used for browsing media contents.

Note: Icon Image Sequence is also supported in DICOMDIR. But only those Icon Images with Bits Allocated (0028,0100) equal to 8 and size of 128x128 pixels are visible in the Browser.

5.2.1.2.1.1 Media Storage Application Profile

See "Table 41 - Mapping of Application Profiles Supported" in section [5.2.1](#) for the Application Profiles listed that invoke this Application Entity for the Browse Directory Information activity.

5.2.1.2.2 Activity "Import into Local Storage"

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

The SOP Instance(s) 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 (Network DCS, 5.1.3), can be retrieved from Media Storage.

For media conforming to the STD-GEN-xxx Profile the following SOP Classes will be supported as FSR:

Table 42 - STD-GEN-xxx profile supported SOP Classes

| Information Object Definition | Transfer Syntax UID |
|--|--|
| Any image SOP Class detailed in "Table 1 - Network Services" section „Transfer (Image SOP Class)“. | Explicit VR Little Endian 1.2.840.10008.1.2.1 |

5.2.1.2.2.1 Media Storage Application Profile

See “Table 41 - Mapping of Application Profiles Supported” in section [5.2.1](#) for the Application Profiles listed that invoke this Application Entity for the Import into Local Storage activity.

5.2.1.3 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.

Table 43 - STD-GEN-xxx profile supported SOP Classes

| Information Object Definition | Transfer Syntax UID |
|--|---|
| X-Ray Angiographic Image Storage | Explicit VR Little Endian 1.2.840.10008.1.2.1 |
| Radiation Dose SR | |
| Secondary Capture Image Storage (as Exam Protocol) | |
| Multi-frame True Color Secondary Capture Image Storage | |

The DICOM Archive application will not finalize the medium.

With the resizing feature of the CIOS Alpha DICOM application, downsized images (8bit) as well as processed images can be written onto medium.

Restrictions and Extensions:

1. The DICOM Offline Storage application supports only SOP Instances generated by the application.
2. It is possible to store images on CD in a “packed” manner. This will result in a DICOMDIR containing “PRIVATE” records instead of “IMAGE” records. This functionality is not intended as exchange media with other systems.
3. It is possible to update a CD containing unpacked images with packed images and vice versa.

5.2.1.3.1.1 Media Storage Application Profile

See “Table 41 - Mapping of Application Profiles Supported” in section [5.2.1](#) for the Application Profiles listed that invoke this Application Entity for the Export to Local Archive Media activity.

5.3 Augmented and Private Application Profiles

not applicable

5.4 Media Configuration

5.4.1 Single- / Multi-Session CD burning

CIOS Alpha always uses the multi-session recording mode.

5.4.2 “Viewer on CD”

syngo FastView as application is included onto the medium as part of the “Viewer on CD” feature, if the feature is checked in the Media Creation user interface

5.4.3 Auto-Labeling

The format of the label is FLC_DDMMYY_HHMM.

6 Support of Extended Character Sets

The CIOS Alpha DICOM application supports the following character sets:

- ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)
- ISO_IR 144 (Cyrillic, supplementary set of ISO 8859, used when Russian patient data input is configured)
- GB18030 (used when Chinese patient data input is configured)
- ISO 2022 IR 13, ISO 2022 IR 87 and ISO 2022 IR 159 (used when Japanese patient data input is configured)

7 Security

The CIOS Alpha is supporting security by having the firewall of the underlying operating system active. Besides the standard ports of the operating system, only the DICOM Port (104) is opened.

CIOS Alpha only accepts DICOM communication from other AE if the related System is configured with its hostname, port and AET.

8 Annexes

8.1 IOD Contents

8.1.1 Created SOP Instances

8.1.1.1 XA Standard Extended SOP Class

The CIOS Alpha system will create images during acquisition and with post processing applications. Those will be encoded as XA Standard Extended SOP Class. Please see the following table for a complete overview of supplied Type 1/2/3 Standard and additional Private Attributes:

The following table uses a number of abbreviations. The abbreviations used in the "Presence of ..." column are:

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

The abbreviations used in the "Source" column:

MWL the attribute value source Modality Worklist
USER the attribute value source is from User input
AUTO the attribute value is generated automatically
MPPS the attribute value is the same as that use for Modality Performed Procedure Step
CONFIG the attribute value source is a configurable parameter

Table 44 - XA acquired or derived image

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|------------------------|-------------|----|---|-------------------|---------------------|
| Specific Character Set | (0008,0005) | CS | From Configuration / RIS | ALWAYS | MWL / CONFIG |
| Image Type | (0008,0008) | CS | See "8.4.1.4 SOP Common Module - Image Type Extensions" | ALWAYS | AUTO |
| SOP Class UID | (0008,0016) | UI | 1.2.840.10008.5.1.4.1.1.12.1 | ALWAYS | AUTO |
| SOP Instance UID | (0008,0018) | UI | Created, same UID used for different send option | ALWAYS | AUTO |
| Study Date | (0008,0020) | DA | <yyyymmdd> | ALWAYS | AUTO |
| Series Date | (0008,0021) | DA | <yyyymmdd> | ALWAYS | AUTO |
| Acquisition Date | (0008,0022) | DA | Date of Original Acquisition (X-Ray event) | ALWAYS | AUTO |
| Content Date | (0008,0023) | DA | Date of Original Acquisition (X-Ray event) | ALWAYS | AUTO |
| Study Time | (0008,0030) | TM | <hhmmss> | ALWAYS | AUTO |
| Series Time | (0008,0031) | TM | <hhmmss> | ALWAYS | AUTO |
| Acquisition Time | (0008,0032) | TM | Time of Original Acquisition (X-Ray event) | ALWAYS | AUTO |
| Content Time | (0008,0033) | TM | Time of Original Acquisition (X-Ray event) | ALWAYS | AUTO |
| Accession Number | (0008,0050) | SH | RIS or "Accession No." input | ALWAYS | MWL / USER |
| Modality | (0008,0060) | CS | XA | ALWAYS | AUTO |
| Manufacturer | (0008,0070) | LO | Siemens | ALWAYS | AUTO |
| Institution Name | (0008,0080) | LO | RIS or "Institution Name" input | ALWAYS | MWL / USER / CONFIG |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|--|-------------|----|---|-------------------|-------------|
| Referring Physician's Name | (0008,0090) | PN | RIS or input | VNAP | MWL / USER |
| Station Name | (0008,1010) | SH | from Configuration hostname | ALWAYS | CONFIG |
| Study Description | (0008,1030) | LO | Requested Procedure Description (0032,1060) from Modality Worklist or Application Group | ALWAYS | MWL / AUTO |
| Procedure Code Sequence | (0008,1032) | SQ | Requested Procedure Code Sequence (0032,1062) from Modality Worklist | ANAP | MWL |
| Series Description | (0008,103E) | LO | Application Name | ALWAYS | USER / AUTO |
| Performing Physician's Name | (0008,1050) | PN | Performing Physician | ANAP | MWL / USER |
| Operator's Name | (0008,1070) | PN | "Operator 1" "Operator 2" input | ANAP | USER |
| Admitting Diagnosis Description | (0008,1080) | LO | "Admitting Diagnosis" | ANAP | MWL |
| Manufacturer's Model Name | (0008,1090) | LO | Fluorospot Compact S1 | ALWAYS | AUTO |
| Referenced Study Sequence | (0008,1110) | SQ | From RIS | ANAP | MWL |
| >Referenced SOP Class UID | (0008,1150) | UI | From RIS | ANAP | MWL |
| >Referenced SOP Instance UID | (0008,1155) | UI | From RIS | ANAP | MWL |
| Referenced Performed Procedure Step Sequence | (0008,1111) | SQ | Set when MPPS is configured | ANAP | MPPS |
| >Referenced SOP Class UID | (0008,1150) | UI | Set when MPPS is configured | ANAP | MPPS |
| >Referenced SOP Instance UID | (0008,1155) | UI | Set when MPPS is configured | ANAP | MPPS |
| Referenced Patient Sequence | (0008,1120) | SQ | From RIS | ANAP | MWL |
| >Referenced SOP Class UID | (0008,1150) | UI | From RIS | ANAP | MWL |
| >Referenced SOP Instance UID | (0008,1155) | UI | From RIS | ANAP | MWL |
| Referenced Image Sequence | (0008,1140) | SQ | From RIS | ANAP | AUTO |
| >Referenced SOP Class UID | (0008,1150) | UI | From RIS | ANAP | AUTO |
| >Referenced SOP Instance | (0008,1155) | UI | From RIS | ANAP | AUTO |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---|-------------|----|--|-------------------|------------|
| UID | | | | | |
| Derivation Description | (0008,2111) | ST | Notes about transformation steps | ALWAYS | AUTO |
| Recommended Display Frame Rate | (0008,2144) | IS | (in f/s) | ANAP | AUTO |
| Irradiation Event UID | (0008,3010) | UI | Unique for one irradiation event | ALWAYS | AUTO |
| Patient's Name | (0010,0010) | PN | RIS or "Patient Name" input | ALWAYS | MWL / USER |
| Patient ID | (0010,0020) | LO | RIS or "Patient ID" input | ALWAYS | MWL / USER |
| Patient's Birth Date | (0010,0030) | DA | RIS or checked "Date of Birth" input | ALWAYS | MWL / USER |
| Patient's Sex | (0010,0040) | CS | RIS or input (M or F or O/unknown) | ALWAYS | MWL / USER |
| Other Patient IDs | (0010,1000) | LO | From RIS / Social Security Number | ANAP | MWL / USER |
| Other Patient Names | (0010,1001) | PN | From RIS | ANAP | MWL |
| Patient's Age | (0010,1010) | AS | Calculated from "Date of Birth" input | ALWAYS | AUTO |
| Patient's Size | (0010,1020) | DS | Patient's height in meters | ANAP | MWL / USER |
| Patient's Weight | (0010,1030) | DS | (in kilograms) | ANAP | MWL / USER |
| Military Rank | (0010,1080) | LO | From RIS | ANAP | MWL / USER |
| Ethnic Group | (0010,2160) | SH | From RIS | ANAP | MWL |
| Additional Patient History | (0010,21B0) | LT | From RIS | ANAP | MWL |
| Patient Comments | (0010,4000) | LT | "Additional Info" | ANAP | MWL/USER |
| Contrast/Bolus Agent | (0018,0010) | LO | n.a. | VNAP | AUTO |
| Cine Rate | (0018,0040) | IS | <acquired frame rate> | ANAP | AUTO |
| KVP | (0018,0060) | DS | <peak KV used> (KV) | ALWAYS | AUTO |
| Device Serial Number | (0018,1000) | LO | <modality serial number> | ALWAYS | AUTO |
| Software Version | (0018,1020) | LO | VG10 | ALWAYS | AUTO |
| Protocol Name | (0018,1030) | LO | Application Name | ALWAYS | AUTO |
| Frame Time | (0018,1063) | DS | (msec/frame) for fixed frame rates | ANAP | AUTO |
| Distance Source to Detector | (0018,1110) | DS | (mm) SID | ALWAYS | AUTO |
| Distance Source to Patient | (0018,1111) | DS | (mm) Only if (0018,1110) is present - shall present if SOD or TOD is known, that means the image is calibrated | ANAP | AUTO |
| Estimated Radiographic Magnification Factor | (0018,1114) | DS | <Ratio of SID/SOD> | ANAP | AUTO |
| Exposure Time | (0018,1150) | IS | <duration of x-Ray exposure>(msec) | ALWAYS | AUTO |
| X-Ray Tube Current | (0018,1151) | IS | (mA) | ALWAYS | AUTO |
| Exposure | (0018,1152) | IS | (mAs) | ALWAYS | AUTO |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---|-------------|----|-----------------------------------|-------------------|-------------|
| Exposure in μ As | (0018,1153) | IS | (μ As) | ALWAYS | AUTO |
| Average Pulse Width | (0018,1154) | DS | (msec) | ALWAYS | AUTO |
| Radiation Setting | (0018,1155) | CS | SC GR | ALWAYS | AUTO |
| Radiation Mode | (0018,115A) | CS | CONTINUOUS PULSED | ALWAYS | AUTO |
| Image and Fluoroscopy Area Dose Product | (0018,115E) | DS | In dGy cm ² | ALWAYS | AUTO |
| Filter Type | (0018,1160) | DS | Defined Terms: NONE,CU_0.1[2]3_MM | ALWAYS | AUTO |
| Imager Pixel Spacing | (0018,1164) | DS | <row space, col space>(mm) | ALWAYS | AUTO |
| Grid | (0018,1166) | DS | NONE FOCUSED | ALWAYS | AUTO |
| Date of Last Calibration | (0018,1200) | DA | <yyyymmdd> | ALWAYS | AUTO |
| Positioner Motion | (0018,1500) | CS | STATIC | ANAP | AUTO |
| Positioner Type | (0018,1508) | CS | CARM | ANAP | AUTO |
| Positioner Primary Angle | (0018,1510) | DS | Zero length | ALWAYS | AUTO |
| Positioner Secondary Angle | (0018,1511) | DS | Zero length | ALWAYS | AUTO |
| Shutter Shape | (0018,1600) | CS | RECTANGULAR | ALWAYS | AUTO / USER |
| Shutter Left Vertical Edge | (0018,1602) | IS | <column number left edge> | ALWAYS | AUTO / USER |
| Shutter Right Vertical Edge | (0018,1604) | IS | <column number right edge> | ALWAYS | AUTO / USER |
| Shutter Upper Horizontal Edge | (0018,1606) | IS | <row number upper edge> | ALWAYS | AUTO / USER |
| Shutter Lower Horizontal Edge | (0018,1608) | IS | <row number lower edge> | ALWAYS | AUTO / USER |
| Detector Conditions Nominal Flag | (0018,7000) | CS | YES NO, if user was notified | ALWAYS | AUTO |
| Detector Temperature | (0018,7001) | DS | <actual value> | ALWAYS | AUTO |
| Detector Type | (0018,7004) | CS | SCINTILLATOR | ALWAYS | AUTO |
| Detector Description | (0018,7006) | LT | Factory Serial Number | ALWAYS | AUTO |
| Detector ID | (0018,700A) | SH | Factory Serial Number | ALWAYS | AUTO |
| Date of Last Detector Calibration | (0018,700C) | DA | <yyyymmdd> | ALWAYS | AUTO |
| Time of Last Detector Calibration | (0018,700E) | TM | <hhmmss> | ALWAYS | Auto |
| Field of View Origin | (0018,7030) | DS | <actual value> | ALWAYS | AUTO |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|-------------------------------|-------------|----|---|-------------------|-------------------|
| Field of View Rotation | (0018,7032) | DS | "0","90","180" or "270" | ALWAYS | AUTO |
| Field of View Horizontal Flip | (0018,7034) | CS | "YES" or "NO" | ALWAYS | AUTO |
| X-Ray Tube Current in μ A | (0018,8151) | DS | (μ A) | ALWAYS | AUTO |
| Study Instance UID | (0020,000D) | UI | From RIS or system generated | ALWAYS | MWL / AUTO |
| Series Instance UID | (0020,000E) | UI | generated | ALWAYS | AUTO |
| Study ID | (0020,0010) | SH | From RIS Requested Procedure ID or system created | ALWAYS | MWL / USER / AUTO |
| Series Number | (0020,0011) | IS | generated | ALWAYS | AUTO |
| Acquisition Number | (0020,0012) | IS | generated | ALWAYS | AUTO |
| Instance Number | (0020,0013) | IS | generated | ALWAYS | AUTO |
| Patient Orientation | (0020,0020) | CS | Zero length | ALWAYS | AUTO |
| Laterality | (0020,0060) | CS | Zero length | ALWAYS | USER |
| Image Comments | (0020,4000) | LT | If entered in UI | VNAP | USER |
| Samples per Pixel | (0028,0002) | US | 1 | ALWAYS | AUTO |
| Photometric Interpretation | (0028,0004) | CS | MONOCHROME2 | ALWAYS | AUTO |
| Number of Frames | (0028,0008) | IS | <number of frames> | VNAP | AUTO |
| Frame Increment Pointer | (0028,0009) | AT | (0018,1063) or (0018,1065) for variable frame rate | VNAP | AUTO |
| Rows | (0028,0010) | US | | ALWAYS | AUTO |
| Columns | (0028,0011) | US | | ALWAYS | AUTO |
| Bits Allocated | (0028,0100) | US | 8 16 | ALWAYS | AUTO |
| Bits Stored | (0028,0101) | US | 8 16 | ALWAYS | AUTO |
| High Bit | (0028,0102) | US | 7 15 | ALWAYS | AUTO |
| Pixel Representation | (0028,0103) | US | 0 | ALWAYS | AUTO |
| Burned In Annotation | (0028,0301) | CS | "NO" | ALWAYS | AUTO |
| Pixel Intensity Relationship | (0028,1040) | CS | LIN LOG DISP | ALWAYS | AUTO |
| Window Center | (0028,1050) | DS | <NAT value> 2 values if (0028,1040) = LOG | ALWAYS | AUTO / USER |
| Window Width | (0028,1051) | DS | <NAT value> 2 values if (0028,1040) = LOG | ALWAYS | AUTO / USER |
| Recommended Viewing Mode | (0028,1090) | CS | SUB NAT | VNAP | AUTO / USER |
| Lossy Image Compression | (0028,2110) | CS | "00" | ALWAYS | AUTO |
| Modality LUT Sequence | (0028,3000) | SQ | (if [0028,1040] = LOG) | ANAP | AUTO |
| >LUT Descriptor | (0028,3002) | VR | <number of LUT entries>, <first pixel value mapped>, <Entry bits allocated> | ANAP | AUTO |
| >Modality LUT | (0028,3004) | LO | US | ANAP | AUTO |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|--------------------------------------|-------------|-------|--|-------------------|--------|
| Type | | | | | |
| >LUT data | (0028,3006) | US-OW | <array of data, accord. descriptor> | ANAP | AUTO |
| Representative Frame Number | (0028,6010) | US | For multiframe | ANAP | AUTO |
| Mask Subtraction Sequence | (0028,6100) | SQ | n.a. | ANAP | AUTO |
| >Mask Operation | (0028,6101) | CS | AVG_SUB | ANAP | AUTO |
| >Mask Frame Number | (0028,6110) | US | (only for AVG_SUB) | ANAP | AUTO |
| Study ID Issuer | (0032,0012) | LO | internal study identifier | ALWAYS | AUTO |
| Requesting Physician | (0032,1032) | PN | From RIS | ANAP | MWL |
| Requesting Service | (0032,1033) | LO | From RIS | ANAP | MWL |
| Requested Procedure Description | (0032,1060) | LO | From RIS | ANAP | MWL |
| Requested Procedure Code Sequence | (0032,1064) | SQ | From RIS | ANAP | MWL |
| >Code Value | (0008,0100) | SH | From RIS | ANAP | MWL |
| >Coding Scheme Designator | (0008,0102) | SH | From RIS | ANAP | MWL |
| >Coding Scheme Version | (0008,0103) | SH | From RIS | ANAP | MWL |
| >Code Meaning | (0008,0104) | LO | From RIS | ANAP | MWL |
| Study Comments | (0032,4000) | LT | Patient Registration input | ANAP | USER |
| Current Patient Location | (0038,0300) | LO | From RIS | ANAP | MWL |
| Performed Procedure Step Start Date | (0040,0244) | DA | supplied, even if MPPS SOP Class is not supported | ALWAYS | AUTO |
| Performed Procedure Step Start Time | (0040,0245) | TM | supplied, even if MPPS SOP Class is not supported | ALWAYS | AUTO |
| Performed Procedure Step ID | (0040,0253) | SH | supplied, even if MPPS SOP Class is not supported, "XAyyyymmddhhmmss" is set with 1st Image acquired | ALWAYS | AUTO |
| Performed Procedure Step Description | (0040,0254) | LO | Value of Study Description | ALWAYS | AUTO |
| Performed Protocol Code Sequence | (0040,0260) | SQ | Same as 0040,0275>0040,0008 | ANAP | MWL |
| Request Attributes Se- | (0040,0275) | SQ | From RIS | ANAP | MWL |

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|--|-------------|-------|--------------------------------|-------------------|------------|
| quence | | | | | |
| >Scheduled Procedure Step Description | (0040,0007) | LO | From RIS | ANAP | MWL |
| >Scheduled Protocol Code Sequence | (0040,0008) | SQ | From RIS | VNAP | MWL |
| >Scheduled Procedure Step ID | (0040,0009) | SH | From RIS | VNAP | MWL |
| >Requested Procedure ID | (0040,1001) | SH | From RIS or "Request ID" input | VNAP | MWL / USER |
| Confidentiality Constraint on Patient Data Description | (0040,3001) | LO | From RIS | ANAP | MWL |
| Pixel Data | (7FE0,0010) | OB-OW | Pixel data | ALWAYS | AUTO |

8.1.1.1 Private Attributes

The CIOS Alpha system will use following private attributes. These values are intended for internal use only:

Table 45 – Private Attributes

| Attribute Name | Tag | VR |
|----------------|--------------------------|----|
| (0017,xx0A) | Blackening correction | SS |
| (0017,xx0B) | Dose Level | SS |
| (0017,xx0C) | SDM | SS |
| (0017,xx0D) | Frame rate | FL |
| (0017,xx0E) | Characteristic curve | LO |
| (0017,xx0F) | Copper Filter | LO |
| (0017,xx10) | Skin Dose | SS |
| (0017,xx11) | Focus | SS |
| (0017,xx14) | Filter level | US |
| (0017,xx16) | Bone level (white/black) | US |
| (0017,xx17) | Contrast | US |
| (0017,xx18) | Brightness | US |
| (0017,xx19) | Shutter X | US |
| (0017,xx1A) | Shutter Y | US |
| (0017,xx1B) | Flip H | US |
| (0017,xx1C) | Flip V | US |
| (0017,xx1E) | Zoom (On / Off) | US |
| (0017,xx1F) | Pan X | SS |
| (0017,xx20) | Pan Y | SS |
| (0017,xx21) | Harmonization | US |
| (0017,xx22) | DSA Mask index | US |
| (0017,xx23) | DSA display sub/nat | US |
| (0017,xx24) | DSA Contrast | US |
| (0017,xx25) | DSA Brightness | US |
| (0017,xx26) | DSA Filter level | US |
| (0017,xx27) | Landmark | US |

| | | |
|-------------|----------------------------------|----|
| (0017,xx28) | Pixelshift X | FL |
| (0017,xx29) | Pixelshift Y | FL |
| (0017,xx48) | Series number | SS |
| (0017,xx49) | Label | SS |
| (0017,xx4D) | Series / Single flag | SS |
| (0017,xx4E) | Series date | LO |
| (0017,xx4F) | Series time | LO |
| (0017,xx50) | Image type | SS |
| (0017,xx52) | Kernel filtro nativo | SS |
| (0017,xx53) | Kernel filtro DSA | SS |
| (0017,xx54) | Harmonization Kernel | SS |
| (0017,xx55) | DSA flag | SS |
| (0017,xx5C) | Overlays (single image) | OW |
| (0017,xx64) | Filter level | US |
| (0017,xx66) | Bone level (white/black) | US |
| (0017,xx67) | Contrast | US |
| (0017,xx68) | Brightness | US |
| (0017,xx85) | Harmonization kernel | US |
| (0017,xx86) | DSA Mask index | US |
| (0017,xx87) | DSA display sub/nat | US |
| (0017,xx88) | DSA Contrast | US |
| (0017,xx89) | DSA Brightness | US |
| (0017,xx8A) | DSA Filter level | US |
| (0017,xx8B) | Landmark | US |
| (0017,xx8C) | Pixelshift X | FL |
| (0017,xx8D) | Pixelshift Y | FL |
| (0017,xx8E) | Shutter X | US |
| (0017,xx8F) | Shutter Y | US |
| (0017,xx90) | FD config: FlipV | US |
| (0017,xx91) | FD config: FlipH | US |
| (0017,xx92) | FD config: Rotation | US |
| (0017,xx93) | FD config: Orientation | US |
| (0017,xxA0) | Laterality | US |
| (0017,xxA1) | R/L label | US |
| (0017,xxA2) | X,Y value respective to cropped | US |
| (0017,xxAA) | System type | US |
| (0017,xxAB) | Ortho Technique | US |
| (0017,xxB0) | Detector calibration temperature | DS |
| (0017,xxBF) | name of the performed OGP | LO |
| (0017,xxC0) | name of the performed Exam | LO |
| (0017,xxC1) | Anatomical measurement | US |
| (0017,xxC2) | Data Model | US |
| (0017,xxC3) | Mark number | US |
| (0017,xxC4) | RIS name | US |
| (0017,xxD0) | Acc. Fluoro time | US |
| (0017,xxD1) | Acc. Dose Area Product | LO |
| (0017,xxD2) | Acc. Skin Dose | LO |

8.1.1.2 Exam Protocol as SC Image

The CIOS Alpha will generate an X-Ray Radiation Dose SR object to store all dose and acquisition relevant information for all irradiation events. An excerpt of this information is displayed to the user as "Exam Protocol". This displayed Exam Protocol can be converted to an SC image. The pixel data contain the protocol data as an image.

All patient level, study level and equipment information is taken from the acquired images of the related procedure.

Acquisition specific information (e.g. KVP, mA) and further information is set either to default values (type 1), set to zero length (type 2) or not set at all.

8.1.1.3 X-Ray Radiation Dose SR SOP Class

The CIOS Alpha will create X-Ray Radiation Dose SRs implementing TID 10001 *Projection X-Ray Radiation Dose*

For every single irradiation event an entry is made into the SR.
The scope of accumulation is "Study" or "Performed Procedure Step", if MPPS is configured.

All patient level, study level and equipment information is taken from the acquired images of the related procedure.

Attribute mapping from Modality Worklist to X-Ray Radiation Dose SR is equal to the mapping into acquired images. Please refer to 8.1.3.

8.1.2 Usage of attributes from received IODs

Please refer to the "SOP specific conformance..." sections in the DICOM networking part of this DCS for more details on attribute specific handling.

8.1.3 Attribute mapping

The relationships between attributes received via Modality Worklist, stored in acquired images and communicated via MPPS are summarized in Table 29 - Basic Worklist C-FIND-RSP Return Key Attributes.

The CIOS Alpha DICOM Application is not performing data coercion.

8.2 Coded Terminology and Templates

n.a.

8.3 Grayscale Image Consistency

The high resolution TFT display monitor option of CIOS Alpha comes with a DICOM Grayscale Standard Display Function (GSDF) compliant factory pre-setting. A typical working environment setup is assumed for ambient light.

8.4 Standard Extended/Specialized/Private SOP Classes

8.4.1 Standard Extended XA

The XA SOP Instances created by CIOS Alpha are standard-extended by adding the following private module attributes.

Table 46 - Private Modules for Standard Extended XA

| IE | Module | Reference | Usage | Note |
|-------|------------------|-----------|-------|--|
| Image | Raw Data | 8.4.1.1 | U | private Filter Information |
| | Post Processing | 8.4.1.2 | U | private Viewing information |
| | Acquisition Data | 8.4.1.3 | U | additional private Information about image Acquisition |

U = User Option

8.4.1.1 Raw Data

Following shadow owner code is used: "Siemens: Thorax/Multix FD Raw Image Settings".

8.4.1.2 Post Processing Module

Following shadow owner code is used: "Siemens: Thorax/Multix FD PostProcessing".

8.4.1.3 Acquisition Data Module

Following shadow owner code is used: "SIEMENS_FLCOMPACT_VA01A_PROC".

8.4.1.4 SOP Common Module - Image Type Extensions

Additional values for the image type attribute are used to designate the purpose of the SOP instance created by the CIOS Alpha system. Please see the following table for details.

Table 47 - Image Type Extensions

| Type of Scene/Image | Image Type |
|------------------------------|--|
| Standard Fluoro Image | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO |
| Fluoro Image Single | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\SINGLE |
| Fluoro Image Scene | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\LOOP |
| SUB Single Image | ORIGINAL\PRIMARY\SINGLE PLANE\STORE MONITOR\SUB |
| SUB Peak Opacification | ORIGINAL\PRIMARY\SINGL EPLANE\ STORE MONITOR\PEAKOP |
| Standard SUB Series | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\SUB |
| Fluoro Image Last Image Hold | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\LIH |
| Roadmap Single Image | ORIGINAL\PRIMARY\SINGLE PLANE\ROADMAP\SINGLE |

| | |
|--|---|
| Standard Roadmap Series | ORIGINAL\PRIMARY\SINGLE PLANE\ROADMAP\LOOP |
| Standard DR | ORIGINAL\PRIMARY\SINGLE PLANE\FLUORO\DR |
| Dose Report as Secondary Capture / Exam Protocol | DERIVED\SECONDARY\SINGLE PLANE\EXAMPROTOCOL |

8.5 Private Transfer Syntaxes

No private Transfer Syntaxes are defined for or requested by CIOS Alpha DICOM application.

Annex A: Index of Tables

| | |
|--|----|
| Table 1 - Network Services | 2 |
| Table 2 - Media Services..... | 3 |
| Table 3 - Implementation Identifying Information | 3 |
| Table 4 - CIOS Alpha DICOM Data Flow Diagram | 9 |
| Table 5 - Presentation Context Table "Verification" | 13 |
| Table 6 - Presentation Context Table "Send to" | 16 |
| Table 7 - Presentation Context Table "Save to local disk" | 20 |
| Table 8 - Supported DIMSE-C Operations - Query/Retrieve SCU | 22 |
| Table 9 - Presentation Context Table "Search..." | 23 |
| Table 10 - C-FIND RQ Search Keys | 23 |
| Table 11 - Status Codes "Search..." | 24 |
| Table 12 - Presentation Context Table "Import..." | 24 |
| Table 13 - C-MOVE RSP Status Codes..... | 25 |
| Table 14 - Presentation Context Table "Print Film"..... | 26 |
| Table 15 - Basic Film Session N-CREATE attributes | 27 |
| Table 16 - Basic Film Session Status Codes | 28 |
| Table 17 - Basic Film Box N-CREATE attributes | 28 |
| Table 18 - Basic Film Box Status Codes..... | 29 |
| Table 19 - Basic Grayscale Image Box N-SET attributes | 29 |
| Table 20 - Basic Grayscale Image Box Status Codes | 29 |
| Table 21 - Presentation LUT N-CREATE attribute..... | 30 |
| Table 22 - Presentation LUT Status Codes..... | 30 |
| Table 23 - Used Printer N-EVENT Report attributes..... | 30 |
| Table 24 - Mandatory Printer N-GET-RSP, N-EVENT-REPORT-RQ attributes | 30 |
| Table 25 - Used Printer N-EVENT Report attributes..... | 31 |
| Table 26 - Mandatory Printer N-GET-RSP, N-EVENT-REPORT-RQ attributes | 31 |
| Table 27 - Presentation Context "Update Worklist" | 33 |
| Table 28 - Supported Broad Worklist Query Search Key Attributes | 33 |
| Table 29 - Basic Worklist C-FIND-RSP Return Key Attributes | 33 |
| Table 30 - Status Codes "Update Worklist"..... | 36 |
| Table 31 - Patient based "narrow query" Search Key Attributes..... | 36 |
| Table 32 - Presentation Context "Patient Registered" | 39 |
| Table 33 - Performed Procedure Step N-CREATE Attributes..... | 39 |
| Table 34 - Status Codes "Patient Registered" | 41 |
| Table 35 - Performed Procedure Step N-SET Attributes | 41 |
| Table 36 - Status Codes "MPPS Update" | 42 |
| Table 37 - Default AET Characteristics | 43 |
| Table 38 - Remote AE Configuration Items..... | 43 |
| Table 39 - General parameter settings and timeouts..... | 44 |
| Table 40 - Application Data Flow DICOM Archive | 45 |
| Table 41 - Mapping of Application Profiles Supported | 47 |
| Table 42 - STD-GEN-xxx profile supported SOP Classes | 47 |
| Table 43 - STD-GEN-xxx profile supported SOP Classes | 48 |
| Table 44 - XA acquired or derived image..... | 51 |
| Table 45 - Private Attributes | 57 |
| Table 46 - Private Modules for Standard Extended XA | 61 |
| Table 47 - Image Type Extensions..... | 61 |

On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products/ services/features included in this brochure are available through the Siemens sales organization worldwide. Availability and packaging may vary by country and are subject to change without prior notice.

The information in this document contains general descriptions of the technical options available and may not always apply in individual cases.

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

In the interest of complying with legal requirements concerning the environmental compatibility of our products (protection of natural resources and waste conservation), we may recycle certain components where legally permissible. For recycled components we use the same extensive quality assurance measures as for factory-new components.

Any technical data contained in this document may vary within defined tolerances. Original images always lose a certain amount of detail when reproduced.

Global Business Unit

Siemens AG
Medical Solutions
X-Ray Products
Henkestrasse 127
DE-91052 Erlangen
Germany
Phone +49 9131 84-0

Global Siemens Headquarters

Siemens AG
Wittelsbacherplatz 2
80333 Muenchen
Germany

**Global Siemens Healthcare
Headquarters**

Siemens AG
Healthcare Sector
Henkestrasse 127
91052 Erlangen
Germany
Phone +49 9131 84-0
www.siemens.com/healthcare

Legal Manufacturer

Siemens AG
Wittelsbacherplatz 2
DE-80333 Muenchen
Germany