

*Philips Medical Systems*

**DICOM**

CONFORMANCE STATEMENT

Allura Xper FD10

Release 1.2



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**PHILIPS**

*DICOM Conformance Statement*

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## 1. INTRODUCTION

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

### 1.1. Scope and Field of Application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Philips Medical Systems. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices. This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM].

### 1.2. Intended Audience

This Conformance Statement is intended for:

- (Potential) customers
- System integrators of medical equipment
- Marketing staff interested in system functionality
- Software designers implementing DICOM interfaces

It is assumed that the reader is familiar with the DICOM standard.

### 1.3. Contents and Structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and Annex 1 and 2 and follows the contents and structuring requirements of DICOM PS 3.2.

### 1.4. Used Definitions, Terms and Abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3 and PS 3.4.

The word Philips in this document refers to Philips Medical Systems.

Some terms refer to IHE (Integrating the Healthcare Enterprise):

#### **Audit Record Repository**

A system unit that receives and collects audit records from multiple systems [IHE].

**Image Archive**

A system that provides long term storage of images, presentation states, Key Image Notes and Evidence Documents [IHE].

**Image Display**

A system that offers browsing of patients' studies. In addition, it may support the retrieval and display of selected sets of images, presentation states, Key Image Notes, and Evidence Documents [IHE].

**Department System Scheduler**

A department-based information system that provides functions related to the management of orders received from external systems or through the department system's user interface. Upon a defined workflow action, makes procedures available for charge posting. The actor defines the action/event that actually causes charges to post [IHE].

**Performed Procedure Step Manager**

A system that re-distribute the Modality Performed Procedure Step Information from the Acquisition Modality or image Creator to the Department System Scheduler/Order Filler and Image Manager [IHE].

**Print Server**

A system that accepts and processes DICOM print requests as a DICOM Print SCP and performs image rendering on hardcopy media. The system must support pixel rendering according to the DICOM Grayscale Standard Display Function [IHE].

**Protected Health Information**

Protected Health Information is considered as information records, and not the flow of information between the systems [IHE].

**Time Server**

A system unit that knows, maintains and distributes the correct time in the enterprise [IHE].

## 1.5. References

- [DICOM] The Digital Imaging and Communications in Medicine  
(DICOM) standard (NEMA PS 3.X):  
National Electrical Manufacturers Association (NEMA)  
Publication Sales 1300 N. 17<sup>th</sup> Street, Suite 1847  
Rosslyn, Va. 22209, United States of America
- [IHE] Integrating the Healthcare Enterprise  
(IHE) Technical Framework Revision 5.4:  
Radiological Society of North America (RSNA), Inc.  
820 Jorie Boulevard, Oak Brook, IL, United States of America
- [NTP] RFC 1305: Network Time Protocol Version 3.
- [SYSLOG] RFC 3164: The BSD Syslog Protocol.
- [TLS] RFC 2246: Transport Layer Security protocol (TLS) v1.0.

## 1.6. Important Note to the Reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

➤ **Interoperability**

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.

It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

➤ **Validation**

Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.

Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

➤ **New versions of the DICOM Standard**

The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.

The user should ensure that any non-Philips provider linking to Philips equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

## 1.7. General Acronyms and Abbreviations.

The following acronyms and abbreviations are used in the document.

- ACC            American College of Cardiology
- ACN            Application Context Name
- ACR            American College of Radiology

- 
- AE Application Entity
  - ANSI American National Standard Institute
  - CIS Cardiology Information System
  - DICOM Digital Imaging and Communication in Medicine
  - DIMSE DICOM Message Service Element
  - EBE Explicit VR Big Endian
  - ELE Explicit VR Little Endian
  - FOP First-Order Prediction (JPEG)
  - IHE Integrating the Healthcare Enterprise
  - ILE Implicit VR Little Endian
  - IOD Information Object Definition
  - MPPS Modality Performed Procedure Step
  - MWL Modality Worklist
  - NEMA National Electrical Manufacturers Association
  - NTP Network Time Protocol
  - PDU Protocol Data Unit
  - RIS Radiology Information System
  - RWA Real World Activity
  - SCP Service Class Provider
  - SCU Service Class User
  - SOP Service Object Pair
  - TCP/IP Transmission Control Protocol/Internet protocol
  - UID Unique Identifier
  - WLM Worklist Management
  - XML Extensible Markup Language



## 2. IMPLEMENTATION MODEL

This document is the DICOM Conformance Statement for the Philips Medical Systems Allura Xper FD10 modality. Allura Xper FD10 is part of the Xper Flat Detector systems. The main features of the Allura Xper FD10 from the integration within a cardiology department point of view are (see Figure 1. ):

- Query a Department System Scheduler for a Modality Worklist (MWL)
- Update a Performed Procedure Step Manager with information about Performed Procedure Steps (MPPS)
- Transfer of DICOM Images to an Image Archive or Image Display
- Transfer of a request for storage commitment to the Image Archive (for the safekeeping of the previously transmitted images)
- Query/Retrieve an Image Archive or Image Display for a list of entries representing Series of DICOM Images
- Print Images on a DICOM Printer

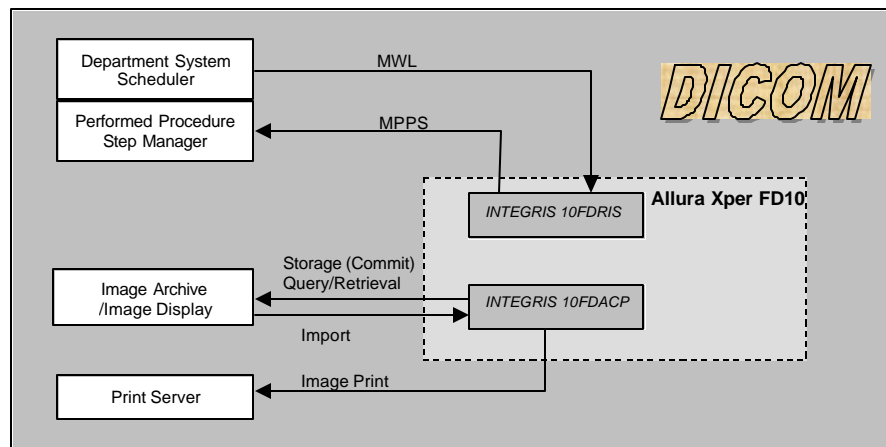
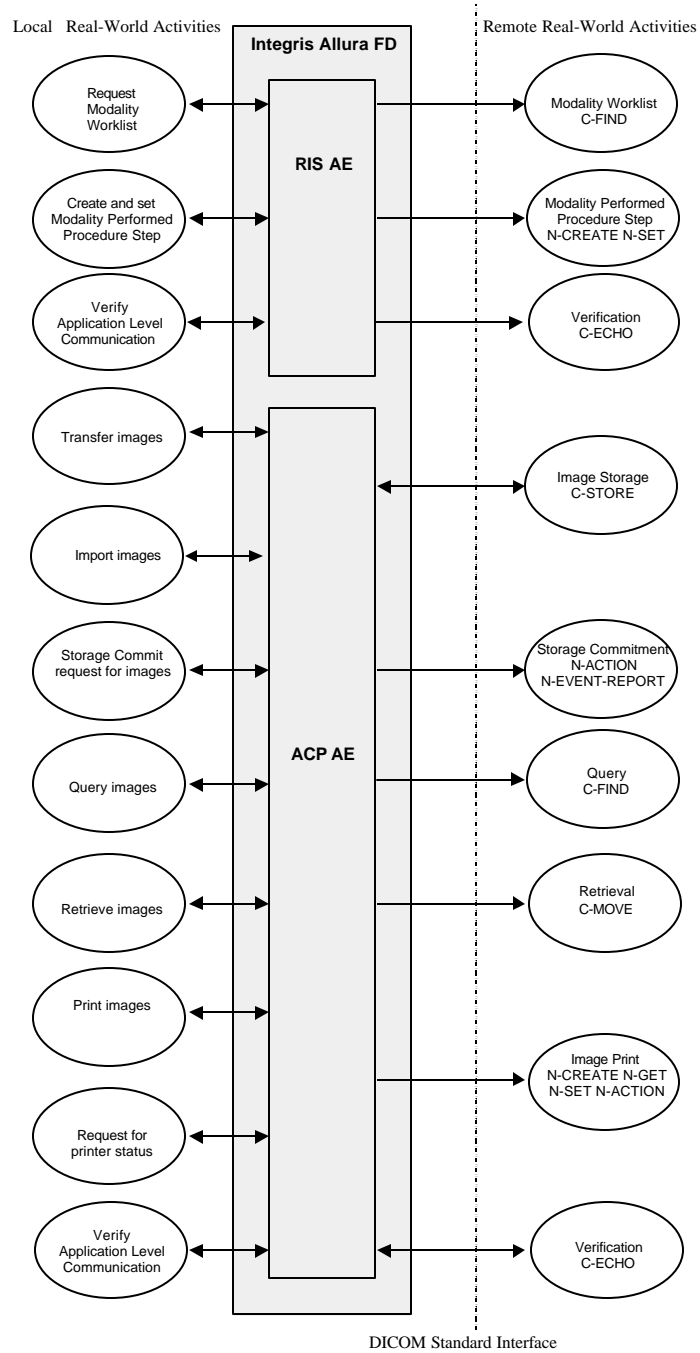


Figure 1. Data Flow of Allura Xper FD10 in a DICOM network

### 2.1. Application Data Flow Diagram

Allura Xper FD10 behaves as a system with two different Application Entities (AE's). Figure 2 shows the AE's present in Allura Xper FD10, and graphically depicts the relationship of the AE's use of DICOM to Real-World Activities. On the left-hand side, the local Real-World Activities are presented, whereas on the right-hand side, the remote Real-World Activities are presented.



As documented in the PS 3.4, the arrows in the diagram have the following meanings:  
 - An arrow pointing to the right indicates the local application entity initiates an association.  
 - An arrow pointing to the left indicates the local application entity accepts an association.

**Figure 2. Allura Xper FD10 Implementation Mode I**

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## 2.2. Functional definition of Application Entities

### 2.2.1. RIS Network AE

The Allura Xper FD10 RIS Application Entity acts as Service Class User (SCU) of the following Services:

- Verification
- Modality Worklist Information Model
- Modality Performed Procedure Step

### 2.2.2. ACP Network AE

The Allura Xper FD10 ACP Network AE acts as Service Class User (SCU) of the following Services:

- Verification
- Image Storage
- Storage Commitment Push Model
- Query
- Retrieval
- Image Print

The Allura Xper FD10 ACP Network AE acts as Service Class Provider (SCP) of the following Services:

- Verification
- Image Storage

## 2.3. Sequencing the Real-World Activities

The following sequence of Real World activities is supported by the system:

- The clinical user queries the Department System Scheduler for a (specific) Worklist representing the list of Scheduled Procedure Steps (with demographic information). Based on that query entered at Allura Xper FD10, it sends the BWLM C-FIND-RQ message with the query criteria.
- The clinical user starts the examination. As a result, Allura Xper FD10 notifies the Performed Procedure Step Manager of the start of a new Procedure Step, i.e. it sends the MPPS N-CREATE-RQ message with the "In Progress" status of the examination.
- The clinical user acquires images with a certain procedure. As a result, if background image transfer is configured, Allura Xper FD10 sends automatically the

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acquired images to the Image Archive and/or the Image Display, i.e., it sends the C-STORE-RQ messages containing the image information.

- The clinical user completes the examination. As a result, if auto-transfer is configured, Allura Xper FD10 sends images to the Image Archive and/or Image Display (background image transfer), i.e., it sends the C-STORE-RQ messages containing the image information.
- When the auto-transfer to the Image Archive is completed and that Image Archive supports storage-commit, Allura Xper FD10 asks the Image Archive to take responsibility for the images that it has stored that originate from the examination, i.e., it sends the N-ACTION-RQ message containing the request for storage commit.
- Allura Xper FD10 notifies the Performed Procedure Step Manager of the completion of a Procedure Step, i.e., it sends the N-SET-RQ message with the Completed status of the examination.

Additionally to the basic flow of activities, the clinical user may also perform the following steps:

- The clinical user manually transfers images to the Image Archive and/or Image Display. As a result, Allura Xper FD10 sends the C-STORE-RQ messages containing the image information.
- The clinical user manually prints selected images. As a result, Allura Xper FD10 sends the N-GET-RQ message to get the printer status, the N-CREATE-RQ message to create the FilmSession and the FilmBox, the N-SET-RQ message to set the Image Box on the printer. Finally, it sends the N-ACTION-RQ message to give printer the command to print.
- The clinical user queries the Image Archive or Image Display for a list of entries representing series of images with the same characteristics. As a result, Allura Xper FD10 sends a number of C-FIND-RQ messages containing the query criteria.
- The clinical user asks for the retrieval of one entry from the Image Archive or Image Display. As a result, Allura Xper FD10 sends the C-MOVE-RQ messages containing the identification of the Series of images to be imported.

## 3. AE SPECIFICATIONS

The Network capabilities of the system consists of two DICOM Application Entities:

- An RIS Network AE
- An ACP Network AE

These are specified in section 3.1 to section 3.2.

### 3.1. RIS Network AE

The Allura Xper FD10 RIS Network Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCU specified in Table 1.

**Table 1. Supported SOP Classes as SCU by the INTEGRIS 10FDRIS**

| SOP Class Name                              | UID                     |
|---|-------------------------|
| Verification                                | 1.2.840.10008.1.1       |
| Modality Worklist Information Model - FIND  | 1.2.840.10008.5.1.4.31  |
| Modality Performed Procedure Step SOP Class | 1.2.840.10008.3.1.2.3.3 |

#### 3.1.1. Association Establishment Policies

##### 3.1.1.1. General

The Allura Xper FD10 RIS Network AE always proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1

The maximum PDU length for receiving data can be configured. The minimum PDU size is 4 Kbytes (4kB) and the maximum PDU length is  $2^{15}$ .

The PDU length for sending data is unrestricted.

##### 3.1.1.2. Number of Associations

A maximum of two associations can exist when a Modality Performed Procedure Step (MPPS) is executed and a Modality Worklist query is issued in parallel.

##### 3.1.1.3. Asynchronous Nature

The RIS Network AE does not support asynchronous operations and will not perform asynchronous window negotiation

**3.1.1.4. Implementation Identifying Information**

The RIS Application Entity will provide the following Implementation UID and Implementation Version Name:

|                                  |                          |
|----------------------------------|--------------------------|
| THE IMPLEMENTATION CLASS UID:    | 1.3.46.670589.7.28.1.2.0 |
| THE IMPLEMENTATION VERSION NAME: | “INTEGRIS 10FDRIS”       |

**3.1.2. Association Acceptance Policy**

The RIS Network Application Entity does not handle incoming associations.

**3.1.3. Association Initiation Policy**

For each request an association to the peer entity is established.

**3.1.3.1. Real-World Activity - Verification**

**3.1.3.1.1. Associated Real-World Activity**

The RIS AE of the Allura Xper FD10 can invoke an association to a remote system.

**3.1.3.1.2. Presentation Context Table**

Allura Xper FD10 RIS Network AE will propose the presentation contexts as given in Table 2.

**Table 2. Proposed Presentation Context for the Verification by the RIS Network AE**

| Abstract Syntax | UID               | Transfer Syntax | UID List            | Role | Ext. Neg. |
|-----------------|-------------------|-----------------|---------------------|------|-----------|
| Verification    | 1.2.840.10008.1.1 | ILE             | 1.2.840.10008.1.2   | SCU  | None      |
|                 |                   | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                 |                   | EBE             | 1.2.840.10008.1.2.2 |      |           |

Note: For Verification ELE is preferred.

**3.1.3.1.3. SOP Specific Conformance**

The RIS Network AE provides standard conformance to the DICOM Verification Service Class.

**3.1.3.2. Real-World Activity – Modality Worklist**

**3.1.3.2.1. Associated Real-World Activity**

For each Broad or Specific Worklist request, an association towards the Basic Worklist Management SCP is established and a C-FIND request is transmitted.

**3.1.3.2.2. Presentation Context Table**

Allura Xper FD10 RIS Network AE will propose the presentation contexts as given in Table 3.

**Table 3. Proposed Presentation Context for the Verification by the RIS Network AE**

| Abstract Syntax | UID                        | Transfer Syntax | UID List            | Role | Ext. Neg. |
|-----------------|----------------------------|-----------------|---------------------|------|-----------|
| MWL - FIND      | 1.2.840.10008.5.1.4.3<br>1 | ILE             | 1.2.840.10008.1.2   | SCU  | None      |
|                 |                            | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                 |                            | EBE             | 1.2.840.10008.1.2.2 |      |           |

Note: For the MWL Information Model – FIND, ELE is preferred.

**3.1.3.2.3. SOP Specific Conformance C-FIND**

Two kinds of queries can be done with the Allura Xper FD10 System. A broad query for the daily Worklist is performed when the Scheduled button is pressed. An specific Worklist request can be initiated by the user, whereas all C-FIND request attributes, listed below, can be set by the user. The tables below will show the Matching Keys for a broad query (Table 4.) and a specific query (Table 5). The content for the specific query is determined on the basis what the clinical user specifies in the Graphical User Interface (GUI). At least one key should be specified. No verification of query results is done.

Attributes shown in the C-FIND response are configurable.

**Table 4. Matching Table MWL Information Model – Broad Query**

| Attribute Name                      | Tag         | Matching Key                         |
|-------------------------------------|-------------|--------------------------------------|
| Scheduled Station AE Title          | (0004,0001) | Single value matching                |
| Scheduled Procedure Step Start Date | (0040,0002) | Universal matching or range matching |
| Scheduled Procedure Step Start Time | (0040,0003) | Universal matching or range matching |
| Modality                            | (0008,0060) | Fixed value matching (always “XA”)   |

**Table 5. Matching Table MWL Information Model – Specific Query**

| Attribute Name                      | Tag         | Matching Key  |
|-------------------------------------|-------------|---|
| Scheduled Station AE Title          | (0004,0001) | Universal matching or single value matching                       |
| Scheduled Procedure Step Start Date | (0040,0002) | Universal matching or range matching                              |
| Modality                            | (0008,0060) | Universal matching or single value matching                       |
| Patient’s Name                      | (0010,0010) | Universal matching or single value matching or wild card matching |
| Patient ID                          | (0010,0020) | Universal matching or single value matching                       |

| Attribute Name         | Tag         | Matching Key                                |
|------------------------|-------------|---|
| Accession Number       | (0008,0050) | Universal matching or single value matching |
| Requested Procedure ID | (0040,1001) | Universal matching or single value matching |

Allura Xper FD10 will query for all DICOM attributes as given in the following tables.

**Table 6. MWL Inf. Model - FIND SOP Class - C-FIND-RQ – Pat. Identification Module**

| Attribute Name    | Tag       | Note |
|-------------------|-----------|------|
| Patient's Name    | 0010,0010 |      |
| Patient ID        | 0010,0020 |      |
| Other Patient IDs | 0010,1000 |      |

**Table 7. MWL Inf. Model - FIND SOP Class - C-FIND-RQ – Pat. Demographic Module**

| Attribute Name                                      | Tag       | Note                      |
|---|-----------|---------------------------|
| Patient's Birth Date                                | 0010,0030 |                           |
| Patient's Birth Time                                | 0010,0032 |                           |
| Patient's Sex                                       | 0010,0040 | Applied Value(s): F, M, O |
| Patient's Size                                      | 0010,1020 |                           |
| Patient's Weight                                    | 0010,1030 |                           |
| Ethnic Group  | 0010,2160 |                           |
| Patient Comments                                    | 0010,4000 |                           |
| Patient Data Confidentiality Constraint Description | 0040,3001 |                           |

**Table 8. MWL Inf. Model - FIND SOP Class - C-FIND-RQ – Pat. Medical Module**

| Attribute Name             | Tag       | Note                                     |
|----------------------------|-----------|--|
| Medical Alerts             | 0010,2000 |  |
| Contrast Allergies         | 0010,2110 |  |
| Additional Patient History | 0010,21B0 |  |
| Pregnancy Status           | 0010,21C0 | Applied Value(s): 0001, 0002, 0003, 0004 |
| Patient State              | 0038,0500 |  |



**Table 9. MWL Inf. Model - FIND SOP Class - C-FIND-RQ - Visit Relationship Module**

| Attribute Name               | Tag       | Note |
|------------------------------|-----------|------|
| Referenced Patient Sequence  | 0008,1120 |      |
| >Referenced SOP Class UID    | 0008,1150 |      |
| >Referenced SOP Instance UID | 0008,1155 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 10. MWL Inf. Model - FIND SOP Class - C-FIND-RQ - Visit Status Module**

| Attribute Name           | Tag       | Note |
|--------------------------|-----------|------|
| Current Patient Location | 0038,0300 |      |

**Table 11. MWL Inf. Model - FIND SOP Class - C-FIND-RQ – Sched. Proc. Step Module**

| Attribute Name                         | Tag       | Note |
|--|-----------|------|
| Scheduled Procedure Step Sequence      | 0040,0100 |      |
| >Modality                              | 0008,0060 |      |
| >Requested Contrast Agent              | 0032,1070 |      |
| >Scheduled Station AE Title            | 0040,0001 |      |
| >Scheduled Procedure Step Start Date   | 0040,0002 |      |
| >Scheduled Procedure Step Start Time   | 0040,0003 |      |
| >Scheduled Performing Physician's Name | 0040,0006 |      |
| >Scheduled Procedure Step Description  | 0040,0007 |      |
| >Scheduled Action Item Code Sequence   | 0040,0008 |      |
| >>Code Value                           | 0008,0100 |      |
| >>Coding Scheme Designator             | 0008,0102 |      |
| >>Code Meaning                         | 0008,0104 |      |
| >Scheduled Procedure Step ID           | 0040,0009 |      |
| >Scheduled Procedure Step Location     | 0040,0011 |      |
| >Pre-Medication                        | 0040,0012 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 12. MWL Inf. Model - FIND SOP Class - C-FIND-RQ - Requested Proc. Module**

| Attribute Name                          | Tag       | Note |
|---|-----------|------|
| Referenced Study Sequence               | 0008,1110 |      |
| >Referenced SOP Class UID               | 0008,1150 |      |
| >Referenced SOP Instance UID            | 0008,1155 |      |
| Study Instance UID                      | 0020,000D |      |
| Requested Procedure Description         | 0032,1060 |      |
| Requested Procedure Code Sequence       | 0032,1064 |      |
| >Code Value                             | 0008,0100 |      |
| >Coding Scheme Designator               | 0008,0102 |      |
| >Code Meaning                           | 0008,0104 |      |
| Requested Procedure ID                  | 0040,1001 |      |
| Reason for the Requested Procedure      | 0040,1002 |      |
| Requested Procedure Priority            | 0040,1003 |      |
| Patient Transport Arrangements          | 0040,1004 |      |
| Requested Procedure Location            | 0040,1005 |      |
| Names of Intended Recipients of Results | 0040,1010 |      |
| Requested Procedure Comments            | 0040,1400 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 13. MWL Inf. Model - FIND SOP Class - C-FIND-RQ - Imaging Service Req. Mod.**

| Attribute Name                         | Tag       | Note |
|--|-----------|------|
| Accession Number                       | 0008,0050 |      |
| Referring Physician's Name             | 0008,0090 |      |
| Requesting Physician                   | 0032,1032 |      |
| Requesting Service                     | 0032,1033 |      |
| Reason for the Imaging Service Request | 0040,2001 |      |
| Issue Date of Imaging Service Request  | 0040,2004 |      |
| Issue Time of Imaging Service Request  | 0040,2005 |      |
| Imaging Service Request Comments       | 0040,2400 |      |

**Table 14. MWL Inf. Model - FIND SOP Class - C-FIND-RQ - Sop Common Module**

| Attribute Name         | Tag       | Note                               |
|------------------------|-----------|------------------------------------|
| Specific Character Set | 0008,0005 | See chapter 7 for more information |

A study Instance UID is received from RIS/CIS or it is generated by the Allura Xper FD10 system. If it is generated by the Allura Xper FD10 system, then it consists of an invariable prefix and a variable suffix and is guaranteed to be unique. It should be noted that the modality maintains one Study Instance UID for a given Accession Number, RequestID combination. This Study Instance UID may be defined on import, on export, or on reception of a scheduled examination from a remote RIS/CIS. Given these conditions, the Study Instance UID of a scheduled examination is not guaranteed to match the Study Instance UID reported in its associated MPPS status message.

**3.1.3.3. Real-World Activity – Modality Performed Procedure Step**

**3.1.3.3.1. Associated Real-World Activity**

During scheduled Worklist an examination is selected for acquisition, and one association towards the Modality Performed Procedure Step SCP is established, and an N-CREATE request with status “IN PROGRESS” is transmitted. Once the responses received, the association is closed. When the examination is cancelled/removed or closed, a new association is established, but now for transmitting a N-SET request. The status field will respectively be set to “DISCONTINUED” or “COMPLETED”. During unscheduled Worklist the N-CREATE request and the N-SET request are transmitted in the same association.

When the transmission fails, the Allura Xper FD10 modality may retry the operation, based on its retry and expiration configuration settings. In the mean time, a persistent copy of the MPPS message is preserved.

**3.1.3.3.2. Presentation Context Table**

Allura Xper FD10 will propose the presentation contexts as given in Table 15.

**Table 15. Proposed Presentation Context for the Verification by the RIS Network AE**

| Abstract Syntax | UID                     | Transfer Syntax | UID List            | Role | Ext. Neg. |
|-----------------|-------------------------|-----------------|---------------------|------|-----------|
| MPPS            | 1.2.840.10008.3.1.2.3.3 | ILE             | 1.2.840.10008.1.2   | SCU  | None      |
|                 |                         | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                 |                         | EBE             | 1.2.840.10008.1.2.2 |      |           |

Note: For Modality Performed Procedure Step, ELE is preferred.

**3.1.3.3.3. SOP Specific Conformance**

The set of attributes within a N-CREATE and/or N-SET message is fixed, not subject to configuration settings. In a N-CREATE message, all possible attributes and attribute

sequences used in the N-SET are forecasted by defining the attributes and settings their values to NULL. When the N-SET message is transmitted, it may occur that a forecasted attribute isn't actually used.

The following rules to the following tables apply:

The "N-CREATE" tables indicates whether or not an attribute and attribute value is sent during N-CREATE. The "N-SET" tables indicates whether or not an attribute and attribute value is sent in the N-SET.

**Table 16. MPPS SOP Class - N-CREATE-RQ - Sop Common Module**

| Attribute Name         | Tag       | Note                               |
|------------------------|-----------|------------------------------------|
| Specific Character Set | 0008,0005 | See chapter 7 for more information |

**Table 17. MPPS SOP Class - N-CREATE-RQ - Image Acquisition Results Module**

| Attribute Name                      | Tag       | Note  |
|-------------------------------------|-----------|---|
| Modality                            | 0008,0060 | Applied Value(s): XA                                      |
| Study ID <sup>Note</sup>            | 0020,0010 |   |
| Performed Action Item Code Sequence | 0040,0260 | Sequence remains empty                                    |
| Performed Series Sequence           | 0040,0340 | Sequence will be empty when there are no images to report |

Note:: If no Study ID is known, the Accession Number will be used as value.

**Table 18. MPPS SOP Class - N-CREATE-RQ – Perf. Procedure Step Inform. Module**

| Attribute Name                      | Tag       | Note  |
|-------------------------------------|-----------|---|
| Procedure Code Sequence             | 0008,1032 |   |
| >Code Value                         | 0008,0100 |   |
| >Coding Scheme Designator           | 0008,0102 |   |
| >Code Meaning                       | 0008,0104 |   |
| Performed Station AE Title          | 0040,0241 | AE Title as configured by the RIS/CIS unit. |
| Performed Station Name              | 0040,0242 |   |
| Performed Location                  | 0040,0243 | Always Empty                                |
| Performed Procedure Step Start Date | 0040,0244 |   |
| Performed Procedure Step Start Time | 0040,0245 |   |
| Performed Procedure Step End Date   | 0040,0250 |   |
| Performed Procedure Step End Time   | 0040,0251 |   |

| Attribute Name                       | Tag       | Note |
|--------------------------------------|-----------|------|
| Performed Procedure Step Status      | 0040,0252 |      |
| Performed Procedure Step ID          | 0040,0253 |      |
| Performed Procedure Step Description | 0040,0254 |      |
| Performed Procedure Type Description | 0040,0255 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 19. MPPS SOP Class - N-CREATERQ – Perf. Procedure Step Relat. Module**

| Attribute Name                        | Tag       | Note |
|---------------------------------------|-----------|------|
| Referenced Patient Sequence           | 0008,1120 |      |
| >Referenced SOP Class UID             | 0008,1150 |      |
| >Referenced SOP Instance UID          | 0008,1155 |      |
| Patient's Name                        | 0010,0010 |      |
| Patient ID                            | 0010,0020 |      |
| Patient's Birth Date                  | 0010,0030 |      |
| Patient's Sex                         | 0010,0040 |      |
| Scheduled Step Attribute Sequence     | 0040,0270 |      |
| >Accession Number                     | 0008,0050 |      |
| >Referenced Study Sequence            | 0008,1110 |      |
| >>Referenced SOP Class UID            | 0008,1150 |      |
| >>Referenced SOP Instance UID         | 0008,1155 |      |
| >Study Instance UID                   | 0020,000D |      |
| >Requested Procedure Description      | 0032,1060 |      |
| >Scheduled Procedure Step Description | 0040,0007 |      |
| >Scheduled Action Item Code Sequence  | 0040,0008 |      |
| >>Code Value                          | 0008,0100 |      |
| >>Coding Scheme Designator            | 0008,0102 |      |
| >>Code Meaning                        | 0008,0104 |      |
| >Scheduled Procedure Step ID          | 0040,0009 |      |
| >Requested Procedure ID               | 0040,1001 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 20. MPPS SOP Class - N-CREATE-RQ - Billing And Mat. Mgmt. Code Module**

| Attribute Name            | Tag       | Note         |
|---------------------------|-----------|--------------|
| Film Consumption Sequence | 0040,0321 | Always empty |

**Table 21. MPPS SOP Class - N-CREATE-RQ - Radiation Dose Module**

| Attribute Name            | Tag       | Note |
|---------------------------|-----------|------|
| Image Area Dose Product   | 0018,115E |      |
| Total Time of Fluoroscopy | 0040,0300 |      |
| Total Number of Exposures | 0040,0301 |      |
| Entrance Dose             | 0040,0302 |      |
| Entrance Dose in mGy      | 0040,8302 |      |

**Table 22. MPPS SOP Class - N-SET-RQ - Image Acquisition Results Module**

| Attribute Name                               | Tag       | Note                                    |
|--|-----------|---|
| Performed Action Item Co de Sequence         | 0040,0260 |   |
| >Code Value                                  | 0008,0100 |   |
| >Coding Scheme Designator                    | 0008,0102 |   |
| >Code Meaning                                | 0008,0104 |   |
| Performed Series Sequence                    | 0040,0340 | May empty when no images to be reported |
| >Performing Physician's Name                 | 0008,1050 |   |
| >Operators Name                              | 0008,1070 |   |
| >Protocol Name                               | 0018,1030 |   |
| >Series Instance UID                         | 0020,000E |   |
| >Series Description                          | 0008,103E |   |
| >Retrieve AE Title                           | 0008,0054 |   |
| >Referenced Image Sequence                   | 0008,1140 |   |
| >>Referenced SOP Class UID                   | 0008,1150 |   |
| >>Referenced SOP Instance UID                | 0008,1155 |   |
| >Referenced Standalone SOP Instance Sequence | 0040,0220 |   |
| >>Referenced SOP Class UID                   | 0008,1150 |   |
| >>Referenced SOP Instance UID                | 0008,1155 |   |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 23. MPPS SOP Class - N-SET-RQ – Perf. Procedure Step Information Module**

| Attribute Name                       | Tag       | Note                                      |
|--------------------------------------|-----------|---|
| Procedure Code Sequence              | 0008,1032 |   |
| >Code Value                          | 0008,0100 |   |
| >Coding Scheme Designator            | 0008,0102 |   |
| >Code Meaning                        | 0008,0104 |   |
| Performed Procedure Step End Date    | 0040,0250 |   |
| Performed Procedure Step End Time    | 0040,0251 |   |
| Performed Procedure Step Status      | 0040,0252 | Applied Values: "COMPLETED" or "DISCONT." |
| Performed Procedure Step Description | 0040,0254 |   |
| Performed Procedure Type Description | 0040,0255 |   |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 24. MPPS SOP Class - N-SET-RQ - Radiation Dose Module**

| Attribute Name            | Tag       | Note |
|---------------------------|-----------|------|
| Image Area Dose Product   | 0018,115E |      |
| Total Time of Fluoroscopy | 0040,0300 |      |
| Total Number of Exposures | 0040,0301 |      |
| Entrance Dose             | 0040,0302 |      |
| Entrance Dose in mGy      | 0040,8302 |      |

**Table 25. MPPS SOP Class - N-SET-RQ - Billing And Material Mgmt. Code Module**

| Attribute Name            | Tag       | Note |
|---------------------------|-----------|------|
| Film Consumption Sequence | 0040,0321 |      |
| >Medium Type              | 2000,0030 |      |
| >Film Size ID             | 2010,0050 |      |
| >Number of Films          | 2100,0170 |      |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 26. MPPS SOP Class - N-SET-RQ - Sop Common Module**

| Attribute Name         | Tag       | Note |
|------------------------|-----------|------|
| Specific Character Set | 0008,0005 |      |

Note: The SOP Common Module is also send during the N-SET Request

## 3.2. ACP Network AE

The Allura Xper FD10 ACP Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCP specified in Table 27.

**Table 27. Supported SOP Classes as SCP by the ACP Network AE**

| SOP Class Name                                      | UID                          |
|---|------------------------------|
| Verification  | 1.2.840.10008.1.1            |
| Secondary Capture Image Storage SOP Class           | 1.2.840.10008.5.1.4.1.1.7    |
| X-Ray Angiographic Image Storage SOP Class (Note 1) | 1.2.840.10008.5.1.4.1.1.12.1 |

Note 1: Only for X-Ray Angiographic Images, which originate from the Allura Xper family.

The Allura Xper FD10 ACP Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCU specified in Table 28.

**Table 28. Supported SOP Classes as SCU by the INTEGRIS 10FDACP**

| SOP Name   | SOP Class UID                |
|--|------------------------------|
| Basic Grayscale Print Management Meta SOP Class    | 1.2.840.10008.5.1.1.9        |
| > Basic Film Box SOP Class                         | 1.2.840.10008.5.1.1.2        |
| > Basic Film Session SOP Class                     | 1.2.840.10008.5.1.1.1        |
| > Basic Grayscale Image Box SOP Class              | 1.2.840.10008.5.1.1.4        |
| > Printer SOP Class                                | 1.2.840.10008.5.1.1.16       |
| Study Root Q/R Information Model - FIND SOP Class  | 1.2.840.10008.5.1.4.1.2.2.1  |
| Study Root Q/R Inf. Model - MOVE SOP Class         | 1.2.840.10008.5.1.4.1.2.2.2  |
| Patient Root Q/R Inf. Model - FIND SOP Class       | 1.2.840.10008.5.1.4.1.2.1.1  |
| Patient Root Q/R Inf. Model - MOVE SOP Class       | 1.2.840.10008.5.1.4.1.2.1.2  |
| X-Ray Angiographic Image Storage SOP Class (Note1) | 1.2.840.10008.5.1.4.1.1.12.1 |
| Secondary Capture Image Storage SOP Class          | 1.2.840.10008.5.1.4.1.1.7    |
| Storage Commitment Push Model SOP Class            | 1.2.840.10008.1.20.1         |



| SOP Name               | SOP Class UID     |
|------------------------|-------------------|
| Verification SOP Class | 1.2.840.10008.1.1 |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class  
 Note 1: Composite Images can either be sent with raw pixel data or processed pixel data. In case of raw pixel data, the unprocessed X-Ray processing is described in private attributes.

### 3.2.1. Association Establishment Policies

#### 3.2.1.1. General

The Allura Xper FD10 ACP Network AE always proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1

The maximum PDU length for receiving data is unrestricted and can be configured ( $0 \leq \text{max. PDU} \leq 2^{32} - 1$  bytes).

The PDU length for sending data is unrestricted.

#### 3.2.1.2. Number of Associations

The maximum number of simultaneous associations initiated by the ACP Network AE (SCU) is in principle unlimited. However in practice, only a maximum of three simultaneous associations can exist when a storage commit or image transfer, a query and a print are issued in parallel.

The maximum number of simultaneous associations supported by the ACP Network AE (SCP) is unlimited by default and can be configured.

#### 3.2.1.3. Asynchronous Nature

The ACP Network AE does support synchronous and asynchronous operations. For storage commitment only asynchronous operations are supported. After the Storage Commit N-ACTION request is transmitted, another Storage Commit notification may be send on another association

#### 3.2.1.4. Implementation Identifying Information

The ACP Application Entity will provide the following Implementation UID and Implementation Version Name:

|                                  |                          |
|----------------------------------|--------------------------|
| THE IMPLEMENTATION CLASS UID:    | 1.3.46.670589.7.28.1.2.1 |
| THE IMPLEMENTATION VERSION NAME: | "INTEGRIS 10FDACP"       |

### 3.2.2. Association Acceptance Policy

The Allura Xper FD10 ACP Network AE accepts Associations for the following purposes:

- To allow remote applications to verify application level communication with the ACP Network AE
- To allow remote applications to store images on Allura Xper FD10
- To receive the Storage Commitment Notification

The ACP Application Entity provides standard conformance to the rejection of an association.

**3.2.2.1. Real-World Activity - Verification**

**3.2.2.1.1. Associated Real-World Activity**

The ACP Network AE accepts (only from configured systems) associations from systems that wish to verify application level communication using the C-ECHO command.

**3.2.2.1.2. Presentation Context Table**

Allura Xper FD10 ACP Network AE will accept the presentation contexts as given in Table 29.

**Table 29. Accepted Presentation Context for the Verification by the ACP Network AE**

| Abstract Syntax | UID               | Transfer Syntax | UID List            | Role | Ext. Neg. |
|-----------------|-------------------|-----------------|---------------------|------|-----------|
| Verification    | 1.2.840.10008.1.1 | ILE             | 1.2.840.10008.1.2   | SCP  | None      |
|                 |                   | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                 |                   | EBE             | 1.2.840.10008.1.2.2 |      |           |

**3.2.2.1.3. SOP Specific Conformance – C-ECHO**

The ACP Network AE provides standard conformance to the DICOM Verification Service Class.

**3.2.2.1.4. Presentation Context Acceptance Criterion**

The ACP Network AE accepts all presentation contexts listed above. If offered a choice of Transfer Syntax’s in a presentation context, the ACP Network AE will choose that Transfer Syntax which is configured as “preferred Transfer Syntax”.

**3.2.2.1.5. Transfer Syntax Selection Policies**

Any of the presentation contexts shown in Table 29 is acceptable.

**3.2.2.2. Real-World Activity – Image Storage**

**3.2.2.2.1. Associated Real-World Activity**

The Allura Xper FD10 system provides standard conformance to the import of images.

**3.2.2.2.2. Presentation Context Table**

Allura Xper FD10 ACP Network AE will accept the presentation contexts as given in Table 30.

**Table 30. Accepted Presentation Context for Image Storage by the ACP Network AE**

| Abstract Syntax  | UID                          | Transfer Syntax       | UID List               | Role | Ext. Neg. |
|--|------------------------------|-----------------------|------------------------|------|-----------|
| Secondary Capture Image Storage SOP Class                    | 1.2.840.10008.5.1.4.1.1.7    | ILE                   | 1.2.840.10008.1.2      | SCP  | None      |
|  |                              | ELE                   | 1.2.840.10008.1.2.1    |      |           |
| X-Ray Angiographic Image Storage SOP Class <sup>Note 1</sup> | 1.2.840.10008.5.1.4.1.1.12.1 | EBE                   | 1.2.840.10008.1.2.2    |      |           |
|  |                              | FOP <sup>Note 2</sup> | 1.2.840.10008.1.2.4.70 |      |           |

Note 1: Only for X-Ray Angiographic Images, which originate from the Allura Xper family.

Note 2: Lossless, Non-Hierarchical, First-Order Prediction JPEG compression.

### 3.2.2.2.3. SOP Specific Conformance – C-STORE

- Only associations from configured systems are accepted. The ACP provides level 2 (full) conformance.

### 3.2.2.2.4. Error Handling

The Allura Xper FD10 system provides standard conformance to the error handling of image import. All error messages occur in a C-STORE response.

### 3.2.2.2.5. Presentation Context Acceptance Criterion

The ACP Network AE accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that the ACP Network AE accepts multiple Proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes. There is no check for duplicate contexts and are therefore accepted.

### 3.2.2.2.6. Transfer Syntax Selection Policies

Any of the presentation contexts shown in Table 30 is acceptable.

## 3.2.3. Association Initiation Policy

For each request an association to the peer entity is established.

### 3.2.3.1. Real-World Activity - Verification

#### 3.2.3.1.1. Associated Real-World Activity

The ACP Network AE can invoke an association to a remote system.

#### 3.2.3.1.2. Presentation Context Table

Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 31.

**Table 31. Proposed Presentation Context for the Verification by the ACP Network AE**

| Abstract Syntax | UID               | Transfer Syntax | UID List            | Role | Ext. Neg. |
|-----------------|-------------------|-----------------|---------------------|------|-----------|
| Verification    | 1.2.840.10008.1.1 | ILE             | 1.2.840.10008.1.2   | SCU  | None      |
|                 |                   | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                 |                   | EBE             | 1.2.840.10008.1.2.2 |      |           |

**3.2.3.1.3. SOP Specific Conformance**

The INTEGRIS 10FDACP provides standard conformance to the DICOM Verification SOP Class.

**3.2.3.2. Real-World Activity – Images Storage**

**3.2.3.2.1. Associated Real-World Activity**

For each image transfer action an association to a remote node is established.

**3.2.3.2.2. Presentation Context Table**

Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 32.

**Table 32. Proposed Presentation Context for Storage by the INTEGRIS 10FDACP**

| Abstract Syntax                      | UID                          | Transfer Syntax       | UID List               | Role | Ext. Neg. |
|--------------------------------------|------------------------------|-----------------------|------------------------|------|-----------|
| SC Image Storage SOP Class           | 1.2.840.10008.5.1.4.1.1.7    | ILE                   | 1.2.840.10008.1.2      | SCU  | None      |
|                                      |                              | ELE                   | 1.2.840.10008.1.2.1    |      |           |
|                                      |                              | EBE                   | 1.2.840.10008.1.2.2    |      |           |
| X-Ray Angiogr. Image Stor. SOP Class | 1.2.840.10008.5.1.4.1.1.12.1 | FOP <sup>Note 1</sup> | 1.2.840.10008.1.2.4.70 |      |           |

Note 1: Lossless, Non-Hierarchical, first-order prediction JPEG compression.

**3.2.3.2.3. SOP Specific Conformance – C-STORE**

The ACP Network AE can exchange image data in the following formats:

- Standard Extended X-Ray Angiographic (1.2.840.10008.5.1.4.1.1.12.1)
- Standard Secondary Capture (1.2.840.10008.5.1.4.1.1.7)

Composite Images can either be send with raw pixel data (Raw Standard Extended X-Ray) or processed pixel data.

**3.2.3.3. Real-World Activity – Storage Commitment**

**3.2.3.3.1. Associated Real-World Activity**

When an examination is closing for which images are transferred to the Image Archive, the ACP Network AE initiates an association for the request of Storage Commitment on that system. Upon completion of the N-ACTION, the association is released (in case of asynchronous communication) or kept open for a specified amount of time (in case of synchronous communication). If a corresponding storage commit notification (N-EVENT-REPORT) is successfully received, the examination is completed.

Upon receiving an N-ACTION response containing a Failure Status, the status will be logged in the system log and the implementation will terminate the association.

**3.2.3.3.2. Presentation Context Table**

Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 33.

**Table 33. Prop. Presentation Context for Storage Commit by the ACP Network AE**

| Abstract Syntax           | UID                    | Transfer Syntax | UID List            | Role | Ext. Neg. |
|---------------------------|------------------------|-----------------|---------------------|------|-----------|
| Storage Commit Push Model | 1.2.840.10008.1.20.1.1 | ILE             | 1.2.840.10008.1.2   | SCU  | None      |
|                           |                        | ELE             | 1.2.840.10008.1.2.1 |      |           |
|                           |                        | EBE             | 1.2.840.10008.1.2.2 |      |           |

Note: ELE is preferred

**3.2.3.3.3. SOP Specific Conformance – N-ACTION**

Storage Commitment is accomplished according to the real world activity described earlier. The ACP Network AE Storage Commitment provides Standard conformance to the Storage Commitment SOP Class.

There are no SOP class specific status codes defined by DICOM for the N-EVENT-REPORT, therefore, only general statuses from DICOM PS 3.7 are used.

**3.2.3.4. Real-World Activity – Query**

**3.2.3.4.1. Associated Real-World Activity**

The operator is able to query a remote database. The ACP Network AE initiates an Association to the selected peer entity and uses it to send C-FIND requests (and receive the associated find replies). For each query a number of C-FIND requests are established in one association to the peer entity, which is released when all query results are received.

**3.2.3.4.2. Proposed Presentation Contexts**

The Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 34.

**Table 34. Proposed Presentation Context for Query by the ACP Network AE**

| Abstract Syntax                          | UID                         | Transfer Syntax   | UID List  | Role | Ext. Neg. |
|--|-----------------------------|-------------------|---|------|-----------|
| Pat. Root Q/R Inf. Model-FIND SOP Class  | 1.2.840.10008.5.1.4.1.2.1.1 | ILE<br>ELE<br>EBE | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU  | None      |
| Pat. Root Q/R Inf. Model-MOVE SOP Class  | 1.2.840.10008.5.1.4.1.2.1.2 |                   |   |      |           |
| Study Root Q/R Inf. Model-FIND SOP Class | 1.2.840.10008.5.1.4.1.2.2.1 |                   |   |      |           |
| Study Root Q/R Inf. Model-MOVE SOP Class | 1.2.840.10008.5.1.4.1.2.2.2 |                   |   |      |           |

Note: ELE is preferred

**3.2.3.4.3. SOP Specific Conformance - C-FIND for Series Level**

With an Allura Xper FD10 System one can query for Series of Images. Series of Images which have the same Study Instance UID (0020,000D), Protocol Name (0018,1030), and Performing Physician's Name (0008,1050), will be presented as one query result. Allura Xper FD10 interprets this as one query result belonging to the same examination.

A query can be done with one of the following DICOM attributes:

**3.2.3.4.3.1. Patient Root Query/Retrieve Information Model - FIND**

**Table 35. Patient level attributes for the Patient Root Q/R Information Model**

| Attribute Name       | Tag       | Matching type   |
|----------------------|-----------|---|
| Patient's Name       | 0010,0010 | Single value matching or wild card matching or universal matching |
| Patient ID           | 0010,0020 | Single value matching or universal matching                       |
| Patient's Birth Date | 0010,0030 | Single value matching or universal matching                       |
| Patient's Sex        | 0010,0040 | Universal matching only   |

**Table 36. Study level keys for the Patient Root Q/R Information Model**

| Attribute Name | Tag       | Matching type                        |
|----------------|-----------|--------------------------------------|
| Study Date     | 0008,0020 | Range matching or universal matching |
| Study Time     | 0008,0030 | Universal matching only              |

| Attribute Name     | Tag       | Matching type   |
|--------------------|-----------|---|
| Accession Number   | 0008,0050 | Single value matching or wild card matching or universal matching |
| Study ID           | 0020,0010 | Universal matching only   |
| Study Instance UID | 0020,000D | Universal matching only   |
| Patient ID         | 0010,0020 | Single value matching or universal matching                       |

**Table 37. Series level attributes for the Patient Root Q/R Information Model**

| Attribute Name              | Tag       | Matching type                               |
|-----------------------------|-----------|---|
| Modality                    | 0008,0060 | Universal matching only                     |
| Series Number               | 0020,0011 | Universal matching only                     |
| Series Instance UID         | 0020,000E | Universal matching only                     |
| Performing Physician's Name | 0008,1050 | Universal matching only                     |
| Protocol Name               | 0018,1030 | Single value matching or universal matching |
| Patient ID                  | 0010,0020 | Single value matching or universal matching |
| Study Instance UID          | 0020,000D | Single value matching only                  |

**3.2.3.4.3.2. Study Root Query/Retrieve Information Model - FIND****Table 38. Study level keys for the Study Root Q/R Information Model**

| Attribute Name       | Tag       | Matching type   |
|----------------------|-----------|---|
| Study Date           | 0008,0020 | Range matching or universal matching                              |
| Study Time           | 0008,0030 | Universal matching only   |
| Accession Number     | 0008,0050 | Value matching or wild card matching or universal matching        |
| Patient's Name       | 0010,0010 | Single value matching or wild card matching or universal matching |
| Patient ID           | 0010,0020 | Single value matching or universal matching                       |
| Patient's Birth Date | 0010,0030 | Single value matching or universal matching                       |
| Patient's Sex        | 0010,0040 | Universal matching only   |
| Study ID             | 0020,0010 | Universal matching only   |
| Study Instance UID   | 0020,000D | Universal matching only   |

**Table 39. Series level attributes for the Study Root Q/R Information Model**

| Attribute Name              | Tag       | Matching type                               |
|-----------------------------|-----------|---|
| Modality                    | 0008,0060 | Universal matching only                     |
| Performing Physician's Name | 0008,1050 | Universal matching only                     |
| Protocol Name               | 0018,1030 | Single value matching or universal matching |
| Study Instance UID          | 0020,000D | Single value matching only                  |
| Series Instance UID         | 0020,000E | Universal matching only                     |
| Series Number               | 0020,0011 | Universal matching only                     |

### 3.2.3.5. Real-World Activity - Retrieval

#### 3.2.3.5.1. Associated Real-World Activity

A request to retrieve a collection of query response items results in a number of C-MOVE requests (one C-MOVE request for each series).

#### 3.2.3.5.2. Proposed Presentation Contexts

The Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 38.

#### 3.2.3.5.3. SOP Specific Conformance - C-MOVE Series Level

Selecting a query result can retrieve only whole examinations. It is not possible to retrieve information if Patient ID contains the sign "grater than" or "less than" (> or <).

#### 3.2.3.5.3.1. Patient Root Query/Retrieve Information Model - MOVE

**Table 40. Series level attributes for the Patient Root Q/R Information Model**

| Attribute Name      | Tag       | Matching type                               |
|---------------------|-----------|---|
| Patient ID          | 0010,0020 | Single value matching or universal matching |
| Study Instance UID  | 0020,000D | Single value                                |
| Series Instance UID | 0020,000E | Single value                                |

#### 3.2.3.5.3.2. Study Root Query/Retrieve Information Model - MOVE

**Table 41. Series level attributes for the Study Root Q/R Information Model**

| Attribute Name      | Tag       | Matching type |
|---------------------|-----------|---------------|
| Series Instance UID | 0020,000E | Single value  |
| Study Instance UID  | 0020,000D | Single value  |



**3.2.3.6. Real-World Activity – Image Print**

**3.2.3.6.1. Associated Real-World Activity**

The operator will select the print destination, out of choice list of configured printers, and some print parameters (depending on the configuration and the selected printer).

As a result, the ACP Network AE initiates an association to the selected printer and uses it to send the Print Service Elements of the Print SOP Classes.

In case of a print job association the printer status is requested in that association. The received printer status is displayed in the Printer Status Tool.

**3.2.3.6.2. Proposed Presentation Contexts**

The Allura Xper FD10 ACP Network AE will propose the presentation contexts as given in Table 42.

**Table 42. Proposed Presentation Context for Print by the ACP Network AE**

| Abstract Syntax                           | UID                   | Transfer Syntax | UID List                                 | Role | Ext. Neg. |
|---|-----------------------|-----------------|--|------|-----------|
| Basic Grayscale Print Mgmt.Meta SOP Class | 1.2.840.10008.5.1.1.9 |                 |  |      |           |
| > Basic Film Session SOP Class            | 1.2.840.10008.5.1.1.1 | ILE<br>ELE      | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU  | None      |
| > Basic Film Box SOP Class                | 1.2.840.10008.5.1.1.2 | EBE             | 1.2.840.10008.1.2.2                      |      |           |
| > Basic Grayscale Image Box SOP Class     | 1.2.840.10008.5.1.1.4 |                 |  |      |           |

Note: ELE is preferred

**3.2.3.6.3. SOP Specific Conformance**

The ACP Network AE provides standard conformance to the Basic Grayscale Print Management Meta SOP Class. The applied order of Print Service Elements (DIMSE's) is specified in Table 43. A description and the applied optional (i.e. non-mandatory attributes as Print SCU) attributes in these Service Elements are specified too. Note that the Service Elements order is not specified by the DICOM standard.

The ACP Network AE does not do an explicit N-DELETE Request on the created instances; these are deleted implicitly when releasing the association. Overlay, Annotation (showing the values of some major identifying attributes) and Shutter information is processed in the images sent to the printer.

**Table 43. The Applied Order of Print Service Elements**

| Service Element of SOP                                 | Description  |
|--|--|
| N-GET of the Printer SOP Class                         | Purpose is to retrieve printer information.  |
| N-CREATE of the Basic Film Session SOP Class           | Specifies the DICOM Printer about some general presentation parameters, applicable for all films in the Film Session.<br>Applied attributes are: Number of Copies, Print Priority, Medium Type, Film Destination                                 |
| N-CREATE of the Basic Film Box SOP Class               | Specifies the DICOM Printer about some general presentation parameters, applicable for all images in the Film Box.<br>Applied attributes are: Film Orientation, Film Size ID, Magnification Type, Max. Density, Configuration Information, Trim. |
| N-SET of the Basic Grayscale/Color Image Box SOP Class | Images to be printed. Applied attributes are: Polarity   |
| N-ACTION of the Basic Film Box SOP Class               | Triggers the DICOM Printer to print. This actual print action is done at film box level. No attributes are present.  |

The Status Codes of Printer N-GET RESPs (Success, Warning, Failure) as returned by the printer will also be logged (for service purposes) and are not indicated towards the operator.

Table 44 specifies the supported Service Elements, which may be generated by the Printer at any time during the association.

**Table 44. The Applied Seq. of Print Service Elements and its Optional Attributes**

| Service Element of SOP                  | Note   |
|---|--|
| N-EVENT-REPORT of the Printer SOP Class | When N-EVENT-REPORT is received, no printer status polling on a separate connection is executed. |

The Status Codes of DIMSE Responses (Success, Warning, Failure) as returned by the printer will also be logged (for service purposes) and are mapped onto general print job status messages towards the operator. These User Interface messages indicate:

- “Job Completed” and has the meaning that the print job is accepted by the printer; the actual printing will be done afterwards.
- “General Print Error” indicating that a failure occurred during the DICOM Print. Also, most warning cases (like default printer values applied on optional print attributes) are interpreted as a print error because this will mostly result in a different print quality or print layout than expected.

The following implementation remarks are important to achieve successful printing:

- The number of Film Boxes per Film Session is one.
- The number of images per Film Box is one. The images to be printed on one film are rendered by the ACP Network AE into one logical image. This logical image is very large, depending on the pixel matrix size (pixels per line, lines per image),. A rough indication is 20 Mbytes. One should take this into account when selecting the DICOM printer and the printer configuration (e.g. the amount of memory).
- The ACP Network AE will release the association when the print command is given (i.e. the N-ACTION Request); the association is not kept open for receiving N-EVENT-REPORTs of the Printer SOP Class.

**3.2.3.6.4. Overview of the applied Print Management Service Elements**

This section gives an overview of the applied attributes in the applied Service Elements of the supported SOP Classes.

Note that not all Service Elements of the SOP Classes are applied, see also section 3.2.3.6.3 on page 27. For the order of sending Service Elements, see same section.

**Table 45. Bas. Film Ses. SOP CLASS-N-CREATE-RQ–Bas. Film Ses. Pres. Mod.**

| Attribute Name   | Tag       | Note   |
|------------------|-----------|--|
| Number of Copies | 2000,0010 | Between 1 and 99.                              |
| Print Priority   | 2000,0020 | Applied value(s): HIGH                         |
| Medium Type      | 2000,0030 | Applied value(s): BLUE FILM, CLEAR FILM, PAPER |
| Film Destination | 2000,0040 | Applied value(s): MAGAZINE, PROCESSOR          |

**Table 46. Basic Film Box SOP Class - N-CREATE- Basic Film Box Pres Mod.**

| Attribute Name       | Tag       | Note  |
|----------------------|-----------|---|
| Image Display Format | 2010,0010 | The applied value below indicates that one (large) image is contained in a Film Box. Applied value(s): CUSTOM1,STANDARD\1,1 (1 is a vendor specific index, i.e. an integer) is applied if the Standard Image Display Format does not result in acceptable films. Purpose of this value is to use the film surface as much as possible for image printing (and avoid large margins). This should be agreed per printer vendor. |
| Film Orientation     | 2010,0040 | Applied value(s): LANDSCAPE, PORTRAIT   |

| Attribute Name            | Tag       | Note   |
|---------------------------|-----------|--|
| Film Size ID              | 2010,0050 | DICOM specifies a number of Defined Terms; more values are possible and is print configuration dependent.  |
| Magnification Type        | 2010,0060 | Normally sent out, however sometimes send out empty<br>Because some DICOM printers are not able to handle<br>(Value NONE for) this attribute. Applied value(s): NONE |
| Trim                      | 2010,0140 |  |
| Configuration Information | 2010,0150 | Contains a vendor specific Lookup-table (LUT); should be applied by the DICOM printer if LUT data is present.  |

**Table 47. Basic Film Box SOP Class-N-CREATE-RQ-Basic Film Box Rel. Mod.**

| Attribute Name                   | Tag       | Matching key                            |
|----------------------------------|-----------|---|
| Referenced Film Session Sequence | 2010,0500 | Parent Film Session.                    |
| > Referenced SOP Class UID       | 0008,1150 | Applied Value(s): 1.2.840.10008.5.1.1.1 |
| > Referenced SOP Instance UID    | 0008,1155 |   |

**Table 48. Basic Film Box SOP Class - N-ACTION**

| Attribute Name        | Tag | Note |
|-----------------------|-----|------|
| No attributes present |     |      |

**Table 49. Bas.Grays. Image.Box SOPClass-N-SET-RQ-ImageBox Pix. Pres. Mod.**

| Attribute Name                        | Tag       | Note                          |
|---------------------------------------|-----------|-------------------------------|
| Image Position                        | 2020,0010 | Applied value(s): 1           |
| Polarity                              | 2020,0020 | Applied value(s): NORMAL      |
| Preformatted Grayscale Image Sequence | 2020,0110 |                               |
| > Samples per Pixel                   | 0028,0002 | Applied value(s): 1           |
| > Photometric Interpretation          | 0028,0004 | Applied value(s): MONOCHROME2 |

| Attribute Name         | Tag        | Note  |
|------------------------|------------|---|
| > Rows                 | 0028,0010  | Depending on the selected printer type and film size. |
| > Columns              | 0028,0011  | Depending on the selected printer type and film size. |
| >Pixel Aspect Ratio    | 0028,0034  |   |
| > Bits Allocated       | 0028,0100  | Applied value(s): 16, 8                               |
| > Bits Stored          | 0028,0101  | Applied value(s): 12, 8                               |
| > High Bit             | 0028,0102  | Applied value(s): 11, 7                               |
| > Pixel Representation | 0028,0103  | Applied value(s): 0x0000                              |
| > Pixel Data           | 7FE0, 0010 |   |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 50. Printer SOP Class - N-GET-RQ - Printer Module**

| Attribute Name      | Tag       | Note   |
|---------------------|-----------|--|
| Printer Status      | 2110,0010 | Polling is not supported. Applied Value(s): FAILURE, NORMAL, WARNING |
| Printer Status Info | 2110,0020 | Applied Value(s): FILM JAM, RECEIVER FULL, SUPPLY EMPTY, SUPPLY LOW  |

**Table 51. Printer SOP Class - N-EVENT-REPORT-RSP - Printer Module**

| Attribute Name      | Tag       | Note  |
|---------------------|-----------|---|
| Printer Status Info | 2110,0020 | Conditionally sent by the Printer. This status information will be ignored. However, polling this status via the N-GET Service Element is done. |

The Allura Xper FD10 ACP Network AE does not send an attribute list to the printer, therefore the only attributes which are needed to be supported by the printer, are the mandatory attributes listed in Table 50, "Printer SOP Class - N-GET".

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## 4. COMMUNICATION PROFILES

### 4.1. Supported Communication Stacks

- DICOM V3.0 TCP/IP is supported
- The TCP/IP stack is inherited from the JAVA virtual machine/NT operating system.
- Physical: as it is supported by the test PC.

### 4.2. Physical Media Support

Supported Physical Medium include:

- Ethernet ISO.8802-3. Standard AUI, optional twisted pair 10-BaseT.

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## 5. EXTENSIONS/SPECIALIZATION/PRIVATIZATION

### 5.1. Extensions

The Standard DICOM SOP Classes may be extended with additional attributes:

- Allura Xper FD10 supports extended Private attributes only in X-Ray Angiographic images.

### 5.2. Specialization

Private attributes are leading. This means: If not explicit indicated that a default value is chosen, the value may be empty.

---

## 6. CONFIGURATION

### 6.1. Configuration RIS

Configuration is stored in a configuration repository.

Local System:

- AE title, port number, IP host name/address
- Maximum PDU size
- ARTIM time out
- Association time out
- Message time out

Basic Worklist Management:

- AE title, port number, IP host name/address
- Time span backwards/forwards
- Is a Secure Node
- Encryption On/Off
- Name of Private key-Certificate pair

Modality Performed Procedure Step:

- AE title, port number, IP host name/address
- Expiration time
- Retry time
- Is a Secure Node
- Encryption On/Off
- Name of Private key-Certificate pair

### 6.2. Configuration ACP

Configuration is stored in a configuration repository.

Local System

- AE title, port number
- Maximum PDU size
- ARTIM time out
- Maximum number of incoming associations
- Is a Secure Node
- Encryption On/Off
- Name of Private key-Certificate pair



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DICOM network node

- AE title, port number, IP hostname/address, Human Readable Name
- Archive/Storage Commitment settings
- ARTIM time out
- Association Timeout SCU
- Supported transfer syntaxes and preferred order as SCU and SCP
- Supported SOP classes as SCU and SCP
- Automatic conversion settings
- Is a Secure Node
- Encryption On/Off
- Default certificate Yes/No
- Name of Private key-Certificate pair

DICOM Printers

- AE title, port number, IP hostname/address, Human Readable Name
- ARTIM time out
- Association Timeout SCU
- Print medium type
- Gray level transformation
- Automatic conversion settings, e.g. pure DICOM.
- Is a Secure Node
- Encryption On/Off
- Default certificate Yes/No
- Name of Private key-Certificate pair

### **6.3. Configuration Time Server**

- Time synchronization On/Off
- Port number, IP hostname/address of the NTP Time Server

### **6.4. Configuration Audit Trail**

- Audit Trail On/Off
- Protocol for Syslog
- Port number, IP hostname/address of the Audit Record Repository

**Attribute mapping**

Several attribute values in the MPPS or Images are either received via Basic Worklist Management (BWLM) or entered by the user locally. The attributes, which can be received via BWLM, should be configured via the Field Service Component (FSC). The user locally cannot change attributes values, which are received via BWLM, as long as a RIS/CIS connection is established.

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## 7. SECURITY

### 7.1. Security Measures

The Allura Xper FD10 allows the use of either a conventional (non-secure) DICOM communication or a secure DICOM communication based on the Transport Layer Security (TLS) protocol [TLS]. If configured, the Allura Xper FD10 supports security measures for:

- secure authentication of a node
- integrity and confidentiality of transmitted data
- replay protection
- generation of audit trail records
- access control and user authentication.

#### 7.1.1. DICOM Basic TLS Secure Transport Connection Profile

Secure communication is a “mode of operation” of the Allura Xper FD10 supported by the implementation of the DICOM Basic TLS Secure Transport Connection Profile [DICOM]. This functionality will be used by the nodes that can authenticate each other before they exchange DICOM information. For secure communication the TLS protocol v1.0 is used which provides message authentication, integrity, confidentiality, and replay protection. Confidentiality is optional and can be controlled by the encryption settings.

The Allura Xper FD10 may communicate using the following Cipher Suites:

- TLS\_RSA\_WITH\_NULL\_SHA (Node authentication without encryption)
- TLS\_RSA\_WITH\_3DES\_SHA (Node authentication with encryption)

The Allura Xper FD10 supports X.509 certificates. The use of self-signed certificates is not supported. The following TLS Certification checks will be done (TLS Handshake). The machine (either server or client) that will send its certificate will:

- Choose the certificate according to Common Name (CN) value in the Subject-field. This name is case-sensitive. All present certificates should have unique CN names.
- The server verifies
  - that the client certificate is a X.509 certificate which is not tampered with
  - that the client certificate is in the list of trusted certificates
  - that the client certificate is not expired (present time is between "Valid From" and "Valid To" fields of the X.509 certificate)
  - that the client certificate has the correct purpose (at least the Client Authentication purpose)
- The client verifies
  - that the server certificate is a X.509 certificate which is not tampered with
  - that the server certificate is in the list of trusted certificates

- that the server certificate is not expired (present time is between "Valid From" and "Valid To" fields of the X.509 certificate)
- that the server certificate has the correct purpose (at least Server Authentication purpose)

No verification is done on:

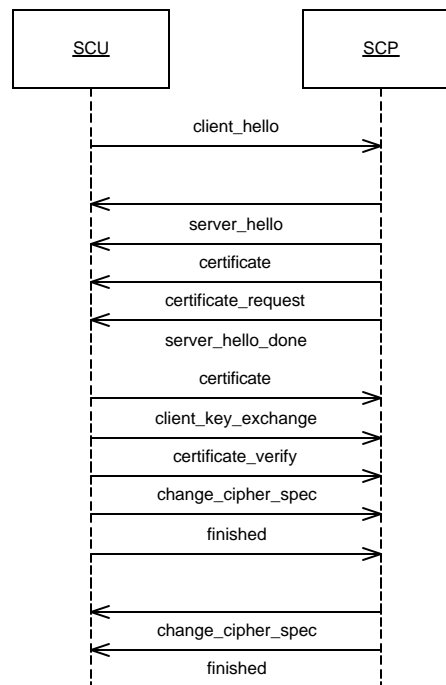
- revocation of certificates
- limiting the connection to a limited set of IP-addresses.

Node authentication with or without encryption is only possible when both nodes have:

- an access to their own private keys
- an access to a copy of the certificate of the other node containing its public key

The Allura Xper FD10 can only read certificates from the certificate stores of the HKEY\_LOCAL\_MACHINE registry key. It is the responsibility of the Hospital to setup and maintain the certificate stores. This includes the removal of revoked certificates and certificate updates prior to their expiration. Since neither X.500 directories, Lightweight Directory Access Protocol (LDAP) nor Certificate Revocation Lists (CRLs) are supported, the whole certificate chain needs to be replaced after a security breach.

Figure 3. presents the message flow of TLS handshake supported by the Allura Xper FD10.



**Figure 3. Message flow of TLS handshake**

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### 7.1.2. Generation of Audit Records

The Allura Xper FD10 can create audit messages according to the IHE Basic Security Integration Profile [IHE] to audit activities, to detect non-compliant behavior in the enterprise, and to facilitate detection of improper creation, access, modification and deletion of Protected Health Information (PHI). These messages may contain information that identifies the patient. The following messages will be created and sent to a central Audit Record Repository according to the Syslog protocol [SYSLOG]:

- ActorConfig (when security or networking configuration of the Allura Xper FD10 is modified via the field service functionality)
- ActorStartStop (when the Allura Xper FD10 starts or shuts down)
- Export (when an examination is saved to a file for field service purposes or printed on a film/paper)
- BeginStoringInstances (when an examination is transferred from the Allura Xper FD10 to a remote network node)
- DICOMInstancesDeleted (when an examination is deleted and it is not scheduled, prepared, or imported)
- DICOMInstancesUsed (when an examination is selected for acquisition)
- UserAuthenticated (when the user logs in or logs out)
- SecurityAlert (when an authentication of a secure node during TLS negotiation [TLS] fails, e.g. Due to an invalid certificate)

If the central Audit Record Repository is not available, the audit trail record will be stored by the Allura Xper FD10 in a local buffer. Once the central Audit Record Repository is available again, the content of that buffer will be transferred to the central Audit Record Repository. The time that is part of the audit message will be the local time of the Allura Xper FD10. This time will be synchronized with a Time Server. The Time Server and central Audit Record Repository are elements of the Hospital infrastructure.

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## 8. SUPPORT OF EXTENDED CHARACTER SETS

### 8.1. Character Sets

Besides the DICOM default character repertoire, ISO 646 Latin Alphabet (ISO-IR 6), the following character sets are supported:

- ISO 8859 Western Europe Supplementary Set 1 (ISO-IR 100)
- JIS X 0201 Japanese Katakana and Romaji (ISO-IR 13 and ISO-IR 14) (only for the patient name)
- JIS X 0208 Japanese Kanji and Hiragana (ISO-IR 87) (only for the patient name)
- JIS X 0212 Japanese Kanji supplementary set (ISO-IR 159) (only for the patient name)

The strings in Allura Xper FD10 are represented in UNICODE.

## ANNEX 1. OVERVIEW APPLIED SOP CLASSES SECONDARY CAPTURE

The details of the applied modules are given in the tables below. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables. The specified attributes are present and filled except for what is specified in the notes.

**Table 52. SC Image Storage SOP Class - C-STORE-RQ - Patient Module**

| Attribute Name               | Tag       | Note                       |
|------------------------------|-----------|----------------------------|
| Referenced Patient Sequence  | 0008,1120 |                            |
| >Referenced SOP Class UID    | 0008,1150 |                            |
| >Referenced SOP Instance UID | 0008,1155 |                            |
| Patient's Name               | 0010,0010 | Patient's full name.       |
| Patient ID                   | 0010,0020 |                            |
| Patient's Birth Date         | 0010,0030 | Birth data of the patient. |
| Patient's Sex                | 0010,0040 | Sex of the named patient.  |
| Other Patient IDs            | 0010,1000 |                            |
| Ethnic Group                 | 0010,2160 |                            |
| Patient Comments             | 0010,4000 |                            |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 53. SC Image Storage SOP Class - C-STORE-RQ - General Study Module**

| Attribute Name               | Tag       | Note                           |
|------------------------------|-----------|--------------------------------|
| Study Date                   | 0008,0020 |                                |
| Study Time                   | 0008,0030 |                                |
| Accession Number             | 0008,0050 |                                |
| Referring Physician's Name   | 0008,0090 | Patient's referring physician. |
| Referenced Study Sequence    | 0008,1110 |                                |
| >Referenced SOP Class UID    | 0008,1150 |                                |
| >Referenced SOP Instance UID | 0008,1155 |                                |
| Study Instance UID           | 0020,000D |                                |
| Study ID                     | 0020,0010 |                                |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 54. SC Image Storage SOP Class - C-STORE-RQ - Patient Study Module**

| Attribute Name             | Tag       | Note                                      |
|----------------------------|-----------|---|
| Patient's Size             | 0010,1020 | Length or size of the Patient, in meters. |
| Patient's Weight           | 0010,1030 | Weight of the Patient, in kilograms.      |
| Additional Patient History | 0010,21B0 |   |

**Table 55. SC Image Storage SOP Class - C-STORE-RQ - General Series Module**

| Attribute Name                       | Tag       | Note   |
|--------------------------------------|-----------|--|
| Series Date                          | 0008,0021 |  |
| Series Time                          | 0008,0031 |  |
| Modality                             | 0008,0060 |  |
| Series Description                   | 0008,103E |  |
| Performing Physician's Name          | 0008,1050 | Name of the Physicians administering the Series. |
| Operator's Name                      | 0008,1070 | Technologist(s) supporting the series.           |
| Referenced Study Component Sequence  | 0008,1111 |  |
| >Referenced SOP Class UID            | 0008,1150 |  |
| >Referenced SOP Instance UID         | 0008,1155 |  |
| Protocol Name                        | 0018,1030 |  |
| Series Instance UID                  | 0020,000E |  |
| Series Number                        | 0020,0011 |  |
| Laterality                           | 0020,0060 |  |
| Performed Procedure Step Start Date  | 0040,0244 |  |
| Performed Procedure Step Start Time  | 0040,0245 |  |
| Performed Procedure Step ID          | 0040,0253 |  |
| Performed Procedure Step Description | 0040,0254 |  |
| Request Attributes Sequence          | 0040,0275 |  |
| >Scheduled Procedure Step ID         | 0040,0009 |  |
| >Requested Procedure ID              | 0040,1001 |  |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 56. SC Image Storage SOP Class - C-STORE-RQ - General Equipment Module**

| Attribute Name | Tag       | Note |
|----------------|-----------|------|
| Manufacturer   | 0008,0070 |      |



| Attribute Name            | Tag       | Note  |
|---------------------------|-----------|---|
| Institution Name          | 0008,0080 |   |
| Station Name              | 0008,1010 |   |
| Manufacturer's Model Name | 0008,1090 | Manufacturers model number of the equipment that produced the digital images. |
| Device Serial Number      | 0018,1000 |   |
| Software Version(s)       | 0018,1020 |   |

**Table 57. SC Image Storage SOP Class - C-STORE-RQ - SC Image Equipment Module**

| Attribute Name  | Tag       | Note               |
|-----------------|-----------|--------------------|
| Conversion Type | 0008,0064 | Applied Value: WSD |

**Table 58. SC Image Storage SOP Class - C-STORE-RQ - General Image Module**

| Attribute Name          | Tag       | Note  |
|-------------------------|-----------|---|
| Content Date            | 0008,0023 |   |
| Content Time            | 0008,0033 |   |
| Instance Number         | 0020,0013 |   |
| Patient Orientation     | 0020,0020 |   |
| Lossy Image Compression | 0028,2110 |   |
| Image Type              | 0008,0008 | Applied value(s):<br>Value 1: DERIVED<br>Value 2: PRIMARY |
| Derivation Description  | 0008,2111 |   |

**Table 59. SC Image Storage SOP Class - C-STORE-RQ - Image Pixel Module**

| Attribute Name             | Tag       | Note |
|----------------------------|-----------|------|
| Rows                       | 0028,0010 |      |
| Columns                    | 0028,0011 |      |
| Pixel Data                 | 7FE0,0010 |      |
| Samples per Pixel          | 0028,0002 |      |
| Photometric Interpretation | 0028,0004 |      |
| Bits Allocated             | 0028,0100 |      |
| Bits Stored                | 0028,0101 |      |
| High Bit                   | 0028,0102 |      |
| Pixel Representation       | 0028,0103 |      |

**Table 60. SC Image Storage SOP Class - C-STORE-RQ - Voi Lut Module**

| Attribute Name | Tag       | Note |
|----------------|-----------|------|
| Window Center  | 0028,1050 |      |
| Window Width   | 0028,1051 |      |

**Table 61. SC Image Storage SOP Class - C-STORE-RQ - Sop Common Module**

| Attribute Name         | Tag       | Note |
|------------------------|-----------|------|
| Specific Character Set | 0008,0005 |      |
| SOP Class UID          | 0008,0016 |      |
| SOP Instance UID       | 0008,0018 |      |

## ANNEX 2. OVERVIEW APPLIED SOP CLASSES X-RAY ANGIOGRAPHIC

The details of the applied modules are given in the tables below. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables. The specified attributes are present and filled except for what is specified in the notes.

**Table 62. X-Ray Angiographic Image Storage SOP Class-C-STORE-RQ – Pat. Module**

| Attribute Name               | Tag       | Note                       |
|------------------------------|-----------|----------------------------|
| Referenced Patient Sequence  | 0008,1120 |                            |
| >Referenced SOP Class UID    | 0008,1150 |                            |
| >Referenced SOP Instance UID | 0008,1155 |                            |
| Patient's Name               | 0010,0010 | Patient's full name.       |
| Patient ID                   | 0010,0020 |                            |
| Patient's Birth Date         | 0010,0030 | Birth data of the patient. |
| Patient's Sex                | 0010,0040 | Sex of the named patient.  |
| Other Patient IDs            | 0010,1000 |                            |
| Ethnic Group                 | 0010,2160 |                            |
| Patient Comments             | 0010,4000 |                            |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

**Table 63. X-Ray Angiographic Image Stor. SOP Class-C-STORE-RQ-Gen. Study Mod.**

| Attribute Name               | Tag       | Note                           |
|------------------------------|-----------|--------------------------------|
| Study Date                   | 0008,0020 |                                |
| Study Time                   | 0008,0030 |                                |
| Accession Number             | 0008,0050 |                                |
| Referring Physician's Name   | 0008,0090 | Patient's referring physician. |
| Referenced Study Sequence    | 0008,1110 |                                |
| >Referenced SOP Class UID    | 0008,1150 |                                |
| >Referenced SOP Instance UID | 0008,1155 |                                |
| Study Instance UID           | 0020,000D |                                |
| Study ID (Note 1)            | 0020,0010 |                                |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

Note 1: In case the Study ID is empty the accession number will be assigned. In case Study ID and Accession Number are the same, the Study ID will be left empty.

**Table 64. X-Ray Angiographic Image Stor. SOP Class-C-STORE-RQ-Pat. Study Mod.**

| Attribute Name             | Tag       | Note                                      |
|----------------------------|-----------|---|
| Patient's Size             | 0010,1020 | Length or size of the Patient, in meters. |
| Patient's Weight           | 0010,1030 | Weight of the Patient, in kilograms.      |
| Additional Patient History | 0010,21B0 |   |

**Table 65. X-Ray Angiographic Image Stor. SOP Class-C-STORE-RQ-Gen. Series Mod.**

| Attribute Name                       | Tag       | Note   |
|--------------------------------------|-----------|--|
| Series Date                          | 0008,0021 |  |
| Series Time                          | 0008,0031 |  |
| Modality                             | 0008,0060 |  |
| Series Description                   | 0008,103E |  |
| Performing Physician's Name          | 0008,1050 | Name of the Physicians administering the Series. |
| Operator's Name                      | 0008,1070 | Technologist(s) supporting the series.           |
| Referenced Study Component Sequence  | 0008,1111 |  |
| >Referenced SOP Class UID            | 0008,1150 |  |
| >Referenced SOP Instance UID         | 0008,1155 |  |
| Protocol Name                        | 0018,1030 |  |
| Series Instance UID                  | 0020,000E |  |
| Series Number                        | 0020,0011 |  |
| Laterality                           | 0020,0060 |  |
| Performed Procedure Step Start Date  | 0040,0244 |  |
| Performed Procedure Step Start Time  | 0040,0245 |  |
| Performed Procedure Step ID          | 0040,0253 |  |
| Performed Procedure Step Description | 0040,0254 |  |
| Request Attributes Sequence          | 0040,0275 |  |
| >Scheduled Procedure Step ID         | 0040,0009 |  |
| >Requested Procedure ID              | 0040,1001 |  |

The ">" character indicates that the SOP Class is part of the above mentioned Meta SOP Class

Note 1: For native images the Series type equals to "SERIES". In case of Secondary Images this attribute will not be sent.

**Table 66. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Gen. Equip. Mod.**

| Attribute Name            | Tag       | Note  |
|---------------------------|-----------|---|
| Manufacturer              | 0008,0070 |   |
| Institution Name          | 0008,0080 |   |
| Station Name              | 0008,1010 |   |
| Manufacturer's Model Name | 0008,1090 | Manufacturers model number of the equipment that produced the digital images. |
| Device Serial Number      | 0018,1000 |   |
| Software Version(s)       | 0018,1020 |   |

**Table 67. X-Ray Angiogr. Image Storage SOP Class-C-STORE-RQ-Gen. Image Mod.**

| Attribute Name          | Tag       | Note  |
|-------------------------|-----------|---|
| Content Date            | 0008,0023 |   |
| Content Time            | 0008,0033 |   |
| Instance Number         | 0020,0013 |   |
| Patient Orientation     | 0020,0020 |   |
| Lossy Image Compression | 0028,2110 |   |
| Image Type              | 0008,0008 | Applied value(s):<br>Value 1: ORIGINAL<br>Value 2: PRIMARY<br>Value 3: SINGLE PLANE |

Note 1: Exported only if the export format is Basic Standard Extended and subtraction has been processed into the exported image.

**Table 68. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Image Pixel Module**

| Attribute Name             | Tag       | Note |
|----------------------------|-----------|------|
| Rows                       | 0028,0010 |      |
| Columns                    | 0028,0011 |      |
| Samples per Pixel          | 0028,0002 |      |
| Photometric Interpretation | 0028,0004 |      |
| Bits Allocated             | 0028,0100 |      |
| Bits Stored                | 0028,0101 |      |
| High Bit                   | 0028,0102 |      |
| Pixel Representation       | 0028,0103 |      |

| Attribute Name | Tag       | Note |
|----------------|-----------|------|
| Pixel Data     | 7FE0,0010 |      |

**Table 69. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Contrast/bolus Mod.**

| Attribute Name       | Tag       | Note |
|----------------------|-----------|------|
| Contrast/Bolus Agent | 0018,0010 |      |

**Table 70. X-Ray Angiogr. Image Storage SOP Class - C-STORE-RQ - Cine Module**

| Attribute Name                 | Tag       | Note |
|--------------------------------|-----------|------|
| Recommended Display Frame Rate | 0008,2144 |      |
| Cine Rate                      | 0018,0040 |      |
| Frame Time                     | 0018,1063 |      |
| Frame Time Vector              | 0018,1065 |      |
| Frame Delay                    | 0018,1066 |      |

**Table 71. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Multi-Frame Module**

| Attribute Name          | Tag       | Note                                       |
|-------------------------|-----------|--|
| Number of Frames        | 0028,0008 |  |
| Frame Increment Pointer | 0028,0009 | Applied Value(s): 0x00181065 or 0x00181063 |

**Table 72. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Disp. Shutter Module**

| Attribute Name                | Tag       | Note                                    |
|-------------------------------|-----------|---|
| Shutter Shape                 | 0018,1600 | Applied Value(s): CIRCULAR, RECTANGULAR |
| Shutter Left Vertical Edge    | 0018,1602 |   |
| Shutter Right Vertical Edge   | 0018,1604 |   |
| Shutter Upper Horizontal Edge | 0018,1606 |   |
| Shutter Lower Horizontal Edge | 0018,1608 |   |
| Center of Circular Shutter    | 0018,1610 |   |
| Radius of Circular Shutter    | 0018,1612 |   |

**Table 73. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-X-ray Image Module**

| Attribute Name | Tag       | Note              |
|----------------|-----------|-------------------|
| Image Type     | 0008,0008 | Applied Value(s): |

| Attribute Name               | Tag       | Note                          |
|------------------------------|-----------|-------------------------------|
|                              |           | ORIGINALPRIMARYSINGLE PLANE   |
| Samples per Pixel            | 0028,0002 | Applied Value(s): 1           |
| Photometric Interpretation   | 0028,0004 | Applied Value(s): MONOCHROME2 |
| Bits Allocated               | 0028,0100 | Applied Value(s): 16, 8       |
| Bits Stored                  | 0028,0101 | Applied Value(s): 10, 8       |
| High Bit                     | 0028,0102 |                               |
| Pixel Representation         | 0028,0103 | Applied Value(s): 0x0000      |
| Pixel Intensity Relationship | 0028,1040 | Applied Value(s): LIN         |

Note 1: Exported only if the export format is Basic Standard Extended and subtraction has been processed into the exported image.

**Table 74. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-X-ray Acquis. Mod.**

| Attribute Name              | Tag       | Note  |
|-----------------------------|-----------|---|
| KVP                         | 0018,0060 |   |
| Exposure Time               | 0018,1150 | Only sent if Exposure (0018,1152) is not sent.  |
| X-Ray Tube Current          | 0018,1151 | Only sent if Exposure (0018,1152) is not sent.  |
| Exposure                    | 0018,1152 | Only sent if Exposure Time (0018,1150) and X-Ray Tube Current (0018,1151) are not sent. |
| Radiation Setting           | 0018,1155 |   |
| Distance Source to Entrance | 0040,0306 |   |

**Table 75. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-XA Positioner Module**

| Attribute Name                       | Tag       | Note                      |
|--------------------------------------|-----------|---------------------------|
| Distance Source to Detector          | 0018,1110 |                           |
| Distance Source to Patient           | 0018,1111 |                           |
| Positioner Motion                    | 0018,1500 | Applied Value(s): DYNAMIC |
| Positioner Primary Angle             | 0018,1510 |                           |
| Positioner Secondary Angle           | 0018,1511 |                           |
| Positioner Primary Angle Increment   | 0018,1520 |                           |
| Positioner Secondary Angle Increment | 0018,1521 |                           |

**Table 76. X-Ray Angiogr. Image Storage SOP Class - C-STORE-RQ - Curve Module**

| Attribute Name            | Tag       | Note  |
|---------------------------|-----------|---|
| Curve Dimensions          | 5000,0005 | Applied Value(s): 2                                   |
| Number of Points          | 5000,0010 |   |
| Type of Data              | 5000,0020 |   |
| Axis Units                | 5000,0030 |   |
| Data Value Representation | 50xx,0103 | Applied Value(s): "0000H"                             |
| Minimum Coordinate Value  | 5000,0104 |   |
| Maximum Coordinate Value  | 5000,0105 |   |
| Curve Data Descriptor     | 50xx,0110 | Applied Value(s):<br>For X: "0000H"<br>For Y: "0001H" |
| Coordinate Start Value    | 5000,0112 |   |
| Coordinate Step Value     | 5000,0114 |   |
| Curve Data                | 5000,3000 |   |

**Table 77. X-Ray Angiogr. Image Storage SOP Class - C-STORE-RQ - Voi Lut Module**

| Attribute Name | Tag       | Note |
|----------------|-----------|------|
| Window Center  | 0028,1050 |      |
| Window Width   | 0028,1051 |      |

**Table 78. X-Ray Angiogr. Image Stor. SOP Class-C-STORE-RQ-Sop Common Module**

| Attribute Name         | Tag       | Note |
|------------------------|-----------|------|
| Specific Character Set | 0008,0005 |      |
| SOP Class UID          | 0008,0016 |      |
| SOP Instance UID       | 0008,0018 |      |