*GE Medical Systems*

# Technical Publications

## Direction 2168245

**REV 0**

## Advantage CR QA
## Quality Assurance Workstation

## Conformance Statement for DICOM v3.0

**Copyright© 1995, 1996 By General Electric Co.**

GE Medical Systems

# REVISION HISTORY

| REV | DATE | REASON FOR CHANGE |
|---|---|---|
| Draft A | August 15, 1996 | Inital Draft |
| Draft B | September 12, 1996 | Changes as per DICOM Standards review. |
| 0 | September 16, 1996 | |

## LIST OF EFFECTIVE PAGES

| SECTION | NUMBER | SECTION | NUMBER |
|---|---|---|---|
| Title Page | a | | |
| Revision History<br>I thru II | a | | |
| Table of Contents<br>i thru iv | a | | |
| Introduction<br>1−1 thru 1−6 | a | | |
| Conformance Statement<br>2−1 thru 2−20 | a | | |
| Advantage CR QA Information Object Definition<br>3−1 thru 3−22 | a | | |
| Advanatge CR QA DICOM Print SCU Conformance<br>4−0 thru 4−2 | a | | |

**THIS PAGE LEFT INTENTIONALLY BLANK**

# TABLE OF CONTENTS

**SECTION 1 − INTRODUCTION ..... 1−1**
1.0 OVERVIEW ..... 1−1
1.1 OVERALL CONFORMANCE STATEMENT DOCUMENTATION STRUCTURE ..... 1−2
1.2 INTENDED AUDIENCE ..... 1−4
1.3 SCOPE AND FIELD OF APPLICATION ..... 1−4
1.4 IMPORTANT REMARKS ..... 1−5
1.5 REFERENCES ..... 1−6
1.6 DEFINITIONS ..... 1−6
1.7 SYMBOLS AND ABBREVIATIONS ..... 1−6
1.8 CONVENTIONS ..... 1−6

**SECTION A − CONFORMANCE STATEMENT ..... 2−1**
A.0 INTRODUCTION ..... 2−1
A.1 IMPLEMENTATION MODEL ..... 2−2
A.1.1 Application Data Flow Diagram ..... 2−2
A.1.2 Functional Definitions of Advantage CR QA DICOM Application Entity ..... 2−3
A.1.3 Sequencing of Real World Activities ..... 2−3
A.1.3.1 Image Send ..... 2−3
A.1.3.2 Image Print ..... 2−3
A.2 AE SPECIFICATIONS ..... 2−4
A.2.1 DICOM Application Entity Specification ..... 2−4
A.2.1.1 Association Establishment Policies ..... 2−4
A.2.1.2 Association Initiation by Real World Activity ..... 2−5
A.2.1.3 Association Acceptance Policy ..... 2−7
A.3 COMMUNICATION PROFILES ..... 2−8
A.3.1 Supported Communication Stacks (Parts 8, 9) ..... 2−8
A.3.2 OSI Stack ..... 2−8
A.3.3 TCP/IP Stack ..... 2−8
A.3.3.1 API ..... 2−8
A.3.3.2 Physical Media Support ..... 2−8
A.3.4 Point−to−Point Stack ..... 2−9
A.4 EXTENSIONS/SPECIALIZATION/PRIVATIZATIONS ..... 2−9
A.4.1 Standard Extended/Specialized/Private SOPs ..... 2−9
A.5 CONFIGURATION ..... 2−9
A.5.1 AE Title/Presentation Address Mapping ..... 2−9
A.5.2 Configurable Parameters ..... 2−9
A.6 SUPPORT OF EXTENDED CHARACTER SETS ..... 2−9

**SECTION 3 − ADVANTAGE CR QA INFORMATION OBJECT DEFINITION ..... 3−1**
3.0 IMAGE ENTITY RELATIONSHIP DIAGRAM ..... 3−1
3.1 ENTITY MODULE TABLES FOR IMAGES ..... 3−2
3.1.1 CR Image IOD Module Table ..... 3−2
3.2 INFORMATION MODULE DEFINITIONS ..... 3−3
3.2.1 Patient Module ..... 3−3

3.2.2 General Study Module . . . . . 3−3
3.2.3 General Series Module . . . . . 3−4
3.2.4 CR Series Module . . . . . 3−4
3.2.5 General Equipment Module . . . . . 3−5
3.2.6 General Image Module . . . . . 3−5
3.2.7 Contrast/Bolus Module . . . . . 3−6
3.2.8 VOI LUT Module . . . . . 3−6
3.2.9 Image Pixel Module . . . . . 3−7
3.2.10 SOP Common Module . . . . . 3−8
3.2.11 CR Image Module . . . . . 3−8
3.2.12 CR Private Image Attributes . . . . . 3−8

**SECTION 4 − ADVANTAGE CR QA DICOM PRINT SCU CONFORMANCE . . . . . 4−1**
4.0 DICOM PRINT APPLICATION ENTITY SPECIFICATIONS . . . . . 4−1
4.0.1 Meta SOP Class Conformance . . . . . 4−1
4.0.2 SOP Specific Conformance . . . . . 4−1
4.1 SOP SPECIFIC CONFORMANCE . . . . . 4−2
4.1.1 Basic Film Session SOP Class . . . . . 4−2
4.1.2 Basic Film Box SOP Class . . . . . 4−3
4.1.3 Basic Grayscale Image Box SOP Class . . . . . 4−4
4.1.4 Printer Sop Class . . . . . 4−5
4.2 ADDITIONAL CONFIGURATION INFORMATION . . . . . 4−6
4.2.1 Required Printer Information . . . . . 4−6
4.2.2 Printer Dependent Configuration . . . . . 4−6
4.2.3 Additional Print Features . . . . . 4−7
4.2.3.1 Printer Dependent LUT's . . . . . 4−7
4.2.3.2 Image Size . . . . . 4−7
4.2.3.3 Image Annotation . . . . . 4−7

# TABLE OF CONTENTS (continued)

TABLE 3.1.1−1 CR Image Information Object Definition (IOD) Module Table . . . . . 3−2
TABLE 3.2.1−1 Patient Module Attributes . . . . . 3−3
TABLE 3.2.2−1 General Study Module Attributes . . . . . 3−3
TABLE 3.2.3−1 General Series Module Attributes . . . . . 3−4
TABLE 3.2.4−1 CR Series Module Attributes . . . . . 3−4
TABLE 3.2.6−1 General Equipment Module Attributes . . . . . 3−5
TABLE 3.2.8−1 General Image Module Attributes . . . . . 3−5
TABLE 3.2.10−1 Contrast/Bolus Module Attributes . . . . . 3−6
TABLE 3.2.11−1 VOI LUT Module Attributes . . . . . 3−6
TABLE 3.2.12−1 Image Pixel Module Attributes . . . . . 3−7
TABLE 3.2.13−1 SOP Common Module Attributes . . . . . 3−8
TABLE 3.2.14−1 CR Image Module Attributes . . . . . 3−8
TABLE 3.3.12−1 CR Private Image Attributes . . . . . 3−8
TABLE 4.1.1−1 Basic Film Session SOP Class Attributes . . . . . 4−2
TABLE 4.1.2−1 Basic Film Box SOP Class Attributes . . . . . 4−3
TABLE 4.1..3−1 Basic Grayscale Image Box SOP Class Attributes . . . . . 4−4
TABLE 4.1.4−1 Printer SOP Class Attributes . . . . . 4−5

# SECTION 1 – INTRODUCTION

## 1.0 OVERVIEW

**Section 1**, *Introduction*, provides general information about the content and scope of this document.

**Section A (2)**, *Conformance Statement*, is the DICOM v3.0 Conformance Statement related to this product. Conformance Statements define the subset of options selected from those offered by the DICOM v3.0 standard.

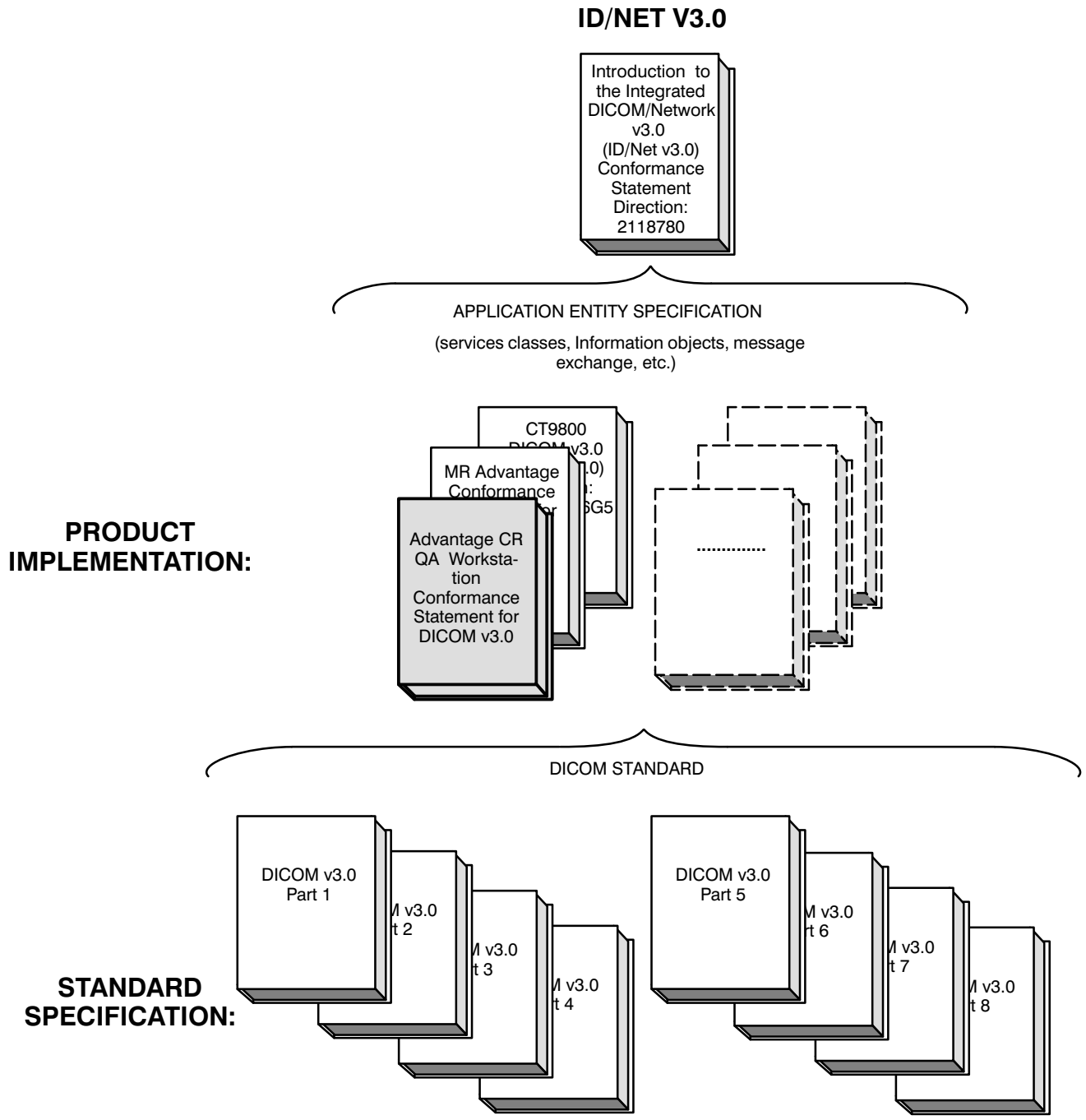
**Section 3**, *Advantage CR QA Information Object Definition*, defines the technical specifications required to interoperate with a GE Medical Systems (GEMS) DICOM v3.0 network interface. They define the technical details of the Information Object Definition (IOD) listed in the Conformance Statement.

**Section 4**, *Advantage CR QA DICOM Print SCU Conformance*, defines the DICOM Print technical specifications required to interoperate with a GE Medical Systems (GEMS) DICOM v3.0 network interface. They define the technical details of the Basic Grayscale Print Management Meta SOP Class listed in the Conformance Statement.

## 1.1 OVERALL CONFORMANCE STATEMENT DOCUMENTATION STRUCTURE

The Documentation Structure of the ID/Net v3.0 Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in Illustration 1−1.

ILLUSTRATION 1−1
**DOCUMENTATION STRUCTURE**



The Documentation Structure given in Illustration 1−1 shows the overall documentation structure for all of the GEMS ID/Net v3.0 Conformance Statements. ID/Net v2.0 documentation is also openly available, but the two documentation structures are independent of one another.

This document specifies the DICOM v3.0 implementation. It is entitled:

*Advantage CR QA*
*Quality Assurance Workstation*
*Conformance Statement for DICOM v3.0*

This Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GEMS ID/Net v3.0 network interface. Introductory information, which is applicable to all GEMS ID/Net v3.0 Conformance Statements, is described in the document:

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)*
*Conformance Statement*
*Direction: 2118780.*

This Introduction familiarizes the reader with DICOM v3.0 terminology and general concepts. It should be read prior to reading the individual products' ID/Net v3.0 Conformance Statements.

The ID/Net v3.0 Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP, OSI, etc.). However, the Technical Specifications are defined in the DICOM v3.0 Part 8 standard.

For more information including Network Architecture and basic DICOM concepts, please refer to the *Introduction.*

For the convenience of software developers, there is a "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published ID/Net v3.0 Product Conformance Statements will be received. The collector Direction is:

*ID/Net v3.0 Conformance Statements*
*Direction: 2117016*

For more information regarding DICOM v3.0, copies of the Standard may be obtained by written request or phone by contacting:

ACR−NEMA / DICOM Representative
NEMA
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209
Phone: 703.841.3285

## 1.2 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM v3.0 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 Standard itself, prior to reading this Conformance Statement document.

*Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)*
*Conformance Statement*
*Direction: 2118780*

## 1.3 SCOPE AND FIELD OF APPLICATION

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GEMS ID/Net v3.0 implementations. This specification, called a Conformance Statement (previously an Implementation Profile), includes a DICOM v3.0 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical image data exchanged using DICOM v3.0. The GEMS ID/Net v3.0 Conformance Statements are available to the public.

Included in the Technical Specification of this Conformance Statement are the Module Definitions which define all data elements used by this GEMS ID/Net v3.0 implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM v3.0 standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a ”full fidelity storage device”, it should retain and retransmit all of the private data elements which are sent by GEMS devices.

## 1.4 IMPORTANT REMARKS

The use of these Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter−operation will be successful.** The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** − The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated Conformance Statements when interoperability with non−GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** − Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.
  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non−GE device, as well as when images acquired on non−GE equipment is processed/displayed on a GE console or workstation.
- **Future Evolution** − GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. ID/Net v3.0 is based on DICOM v3.0 as specified in each ID/Net DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these ID/Net DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **To be kept informed of the evolution of the implementation described in this document, the user should register on the GE Internet Server, accessible via anonymous ftp, by entering his/her e−mail address (GE Internet Server Address : ftp.med.ge.com : 192.88.230.11).**
- **Interaction** − It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

## 1.5 REFERENCES

A list of references which is applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

## 1.6 DEFINITIONS

A set of definitions which is applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

## 1.7 SYMBOLS AND ABBREVIATIONS

A list of symbols and abbreviations which is applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

## 1.8 CONVENTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for the Attribute Type Definitions which are used in the Module Descriptions found in section 3 of this conformance statement.

# SECTION A − CONFORMANCE STATEMENT

## A.0 INTRODUCTION

This Conformance Statement (CS) specifies the GE Advantage CR QA Workstation compliance to DICOM v3.0. It details the DICOM Service Classes and Roles which are supported by this product. Other sections of this document describe the Information Object data elements which are used by this implementation.

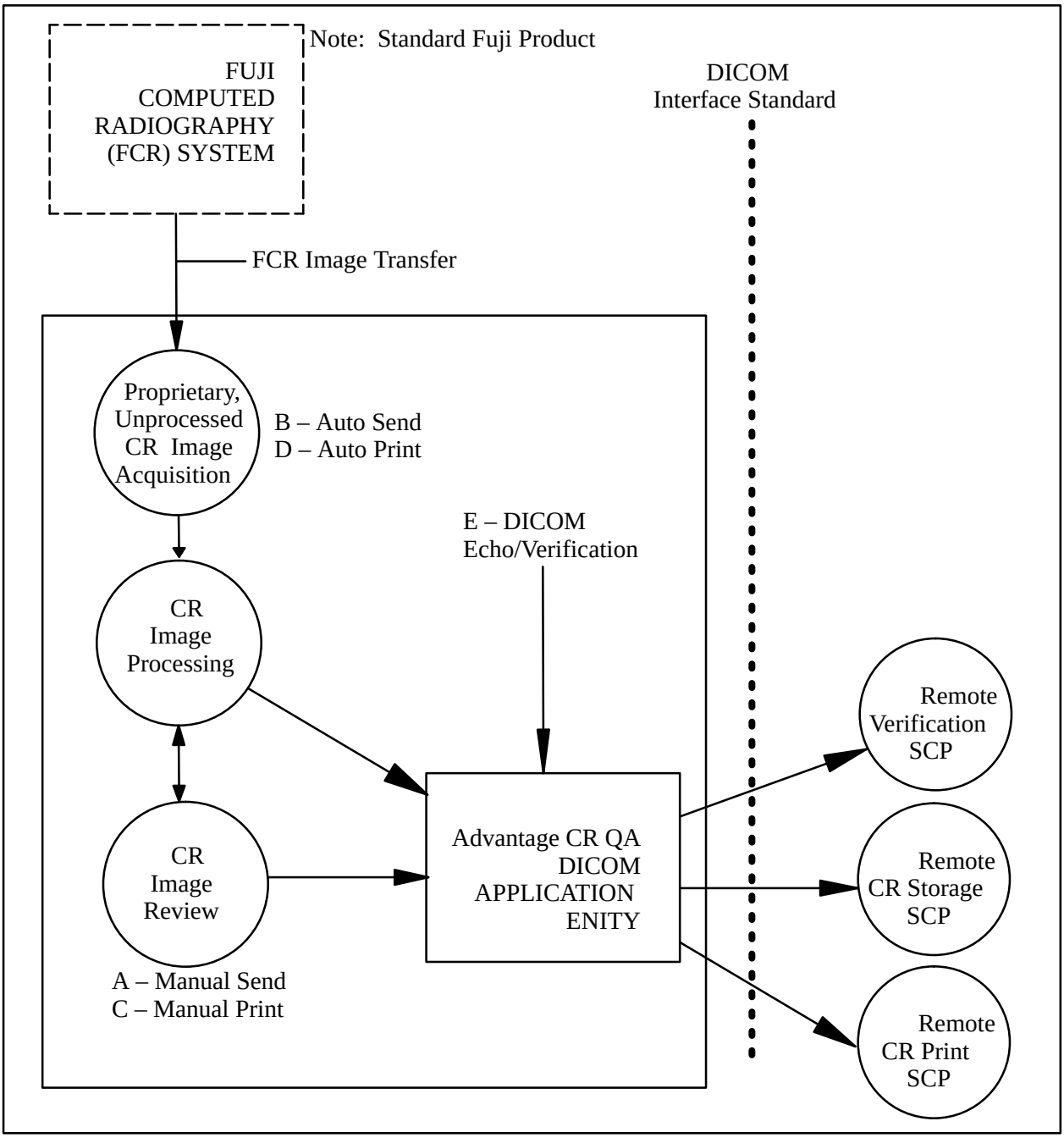
Note that the format of this section strictly follows the format of DICOM Standard Part 2 (Conformance) Appendix A. Please refer to that part of the standard while reading this section.

## A.1 IMPLEMENTATION MODEL

### A.1.1 Application Data Flow Diagram

The Application Data Flow Diagram, showing the Application Entities relationship to Real World Activities, is shown in Illustration A.1.1–1.

ILLUSTRATION A.1.1 – 1
**SPECIFIC AE APPLICATION MODEL**



The Advantage CR QA DICOM Application Entity (AE) is invoked by the following Real World Activities:

- Manual Send One Image (A)
- Auto–Send One Image (B)
- Manual Print One Image (C)
- Auto–Print One Image (D)
- DICOM Echo/Verification Tool (E)

Auto–Send One Image automatically transmits an image to a remote DICOM Storage SCP destination upon acquisition of that image (ie. User Interface (UI) intervention is not required).

Manual Send One Image transmits the currently–displayed image to a remote DICOM Storage SCP destination.

Auto–Print One Image automatically transmits an image to a remote DICOM Print SCP destination upon acquisition of that image (ie. User Interface (UI) intervention is not required).

Manual Print One Image transmits the currently–displayed image to a remote DICOM Print SCP destination.

DICOM Echo/Verification Tool is a service tool that verifies DICOM communication to a remote DICOM destination.

Note: DICOM Send and Print transmit only processed CR image objects. Internally, all CR image objects are stores as unprocessed and images are processed for DICOM transmission and/or viewing.

### A.1.2 Functional Definitions of Advantage CR QA DICOM Application Entity

The Advantage CR QA DICOM Application Entity supports the following functions:

- Converts acquired images to DICOM CR Information Objects
- Negotiates and establishes DICOM association with remote destination
- Sends DICOM Information Objects to remote destination.
- Notifies Process Manager of communication status.

### A.1.3 Sequencing of Real World Activities

#### A.1.3.1 Image Send

- Initiates a DICOM association
- Selects appropriate Abstract and Transfer syntaxes from those accepted by the remote AE
- Uses the C–STORE operation to send the image.

#### A.1.3.2 Image Print

- Initiates a DICOM association
- Selects appropriate Abstract and Transfer Syntaxes from those accepted by the remote AE
- Uses the N–GET operation to get DICOM Print SCP status
- Uses the N–CREATE operation to create a Basic Film Session SOP Instance
- Uses the N–CREATE operation to create a Basic Film Box SOP Instance
- Uses the N–SET operation to update Basic Image Box IOD
- Uses the N–ACTION operation to print the the Film Session

## A.2 AE SPECIFICATIONS

### A.2.1 DICOM Application Entity Specification

The Advantage CR QA DICOM Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

| SOP Class Name | SOP Class UID |
|---|---|
| Verification | 1.2.840.10008.1.1 |
| Computed Radiography Image Storage | 1.2.840.10008.5.1.4.1.1.1 |
| Basic Grayscale Print Management | 1.2.840.10008.5.1.1.9 |

#### A.2.1.1 Association Establishment Policies

##### A.2.1.1.1 General

The following Application Context Name is proposed and recognized by Advantage CR QA DICOM Application Entity :

| | |
|---|---|
| DICOM V3.0 Application Context | 1.2.840.10008.3.1.1.1 |

The maximum length Protocol Data Unit (PDU) is 100KB. The maximum length PDU information is included in the message header at the association negotiation time.

##### A.2.1.1.2 Number of Associations

The Advantage CR QA DICOM Application Entity supports a maximum of two associations, one for Send and one for Print, simultaneously.

##### A.2.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

#### A.2.1.1.4 Implementation Identifying Information

The implementation UID allows unique identification of a set of products that share the same DICOM implementation. The Implementation UID for this implementation is:

| | |
|---|---|
| Implementation UID | 1.2.840.113532.1.1 |

### A.2.1.2 Association Initiation by Real World Activity

Advantage CR QA DICOM Application Entity initiates an association when the following activities occur:

A. Manual Send (multiple images can be selected by the operator and sent to a selected destination) is initiated from the UI.
B. Auto Send is initiated by an acquisition task. There is no operator intervention in this case; the UI process must be running.
C. Manual Print (multiple images can be selected by the operator and printed to a selected destination) is initiated from the UI.
D. Auto Print is initiated by an acquisition task. There is no operator intervention in this case; the UI process must be running.
E. DICOM Tool (Echo) is initiated from the Service Tool.

#### A.2.1.2.1 Real World Activities A and B

Two different real world activities (A and B) can launch an image send process, the DICOM Association Initiation and Transfer Process are identical for each case. In either case (A or B), a DICOM C–STORE is initiated. There is one association per image (multiple images in a study will be transferred with multiple associations).

##### A.2.1.2.1.1 Associated Real−World Activity

Upon manual or automatic request, DICOM Application Entity sends (C–STORE) images to the DICOM Storage SCP on the destination system.

##### A.2.1.2.1.2 Proposed Presentation Contexts

DICOM Application Entity proposes the Presentation Context for Real World Activities A and B as shown below:

**Presentation Context Table**

| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
|---|---|---|---|---|---|
| **Name** | **UID** | **Name List** | **UID List** | | |
| CR Image Info Object | 1.2.840.10008.5.1.4.1.1.1 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

#### A.2.1.2.1.3 SOP Class Status Codes

DICOM Application Entity recognizes the following Storage SOP Class status codes:

| Service Status | Further Meaning | Protocol Code | Description / Action |
|---|---|---|---|
| Error | Failed | C000 | Send not successful |
| Success | Success | 0000 | Send successful |

#### A.2.1.2.2 Real World Activities C and D

Two different real world activities (C and D) can launch an image print process, the DICOM Association Initiation and Transfer Process are identical for each case.

#### A.2.1.2.2.1 Associated Real−World Activity

Upon manual or automatic request, DICOM Application Entity prints images to the DICOM Print SCP on the destination system.

#### A.2.1.2.2.2 Proposed Presentation Contexts

DICOM Application Entity proposes the Presentation Context for Real World Activities C and D as shown below:

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Basic Grayscale Print Management | 1.2.840.10008.5.1.1.9 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

#### A.2.1.2.2.3 SOP Class Status Codes

Refer to Section 4 for the Basic Grayscale Print Management SOP Class status codes the DICOM Application Entity recognizes.

#### A.2.1.2.3 Real World Activity E

Real world activity (E) requests verification of DICOM communication to a remote DICOM Verification SCP.

##### A.2.1.2.3.1 Associated Real−World Activity

Upon manual request, DICOM Application Entity requests verification of communication to the DICOM Verification SCP on the destination system.

#### A.2.1.2.4 Real World Activity E

Real world activity (E) requests verification of DICOM communication to a remote DICOM Verification SCP.

##### A.2.1.2.4.1 Proposed Presentation Contexts

DICOM Application Entity proposes the following Presentation Context for Real–World Activity E below:

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Verification | 1.2.840.10008.1.1 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

##### A.2.1.2.4.2 SOP Class Status Codes

DICOM Application Entity recognizes the following Verification SOP Class status codes:

| Service Status | Further Meaning | Protocol Code | Description / Action |
|---|---|---|---|
| Error | Failed | C000 | Verification not successful |
| Success | Success | 0000 | Verification successful |

#### A.2.1.3 Association Acceptance Policy

DICOM Application Entity never accepts a DICOM association request.

## A.3 COMMUNICATION PROFILES

### A.3.1 Supported Communication Stacks (Parts 8, 9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

### A.3.2 OSI Stack

OSI stack is not supported.

### A.3.3 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

#### A.3.3.1 API

Not applicable to this product.

#### A.3.3.2 Physical Media Support

DICOM is indifferent to the physical medium over which TCP/IP executes (e.g., Ethernet V2.0 IEEE 802.3, ATM, FDDI).

### A.3.4 Point−to−Point Stack

Not applicable to this product.

## A.4 EXTENSIONS/SPECIALIZATION/PRIVATIZATIONS

### A.4.1 Standard Extended/Specialized/Private SOPs

The CR Storage SOP Class used for this product is a Standard Extended SOP class. See Section 3.

## A.5 CONFIGURATION

### A.5.1 AE Title/Presentation Address Mapping

The Local AE Title is configurable. This must be configured by a Field Service Engineer during installation.

### A.5.2 Configurable Parameters

The following fields are configurable for the AE (local):

- Local AE Title
- Local IP Address
- Local Alias

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Responding TCP/IP Port
- Remote IP Address.
- Remote Alias

## A.6 SUPPORT OF EXTENDED CHARACTER SETS

The following character sets are known to be supported:

- ISO–IR 6 (default) Basic G0 Set
- ISO–IR 100 Latin Alphabet No. 1

THIS PAGE LEFT INTENTIONALLY BLANK

# SECTION 3 – ADVANTAGE CR QA INFORMATION OBJECT DEFINITION

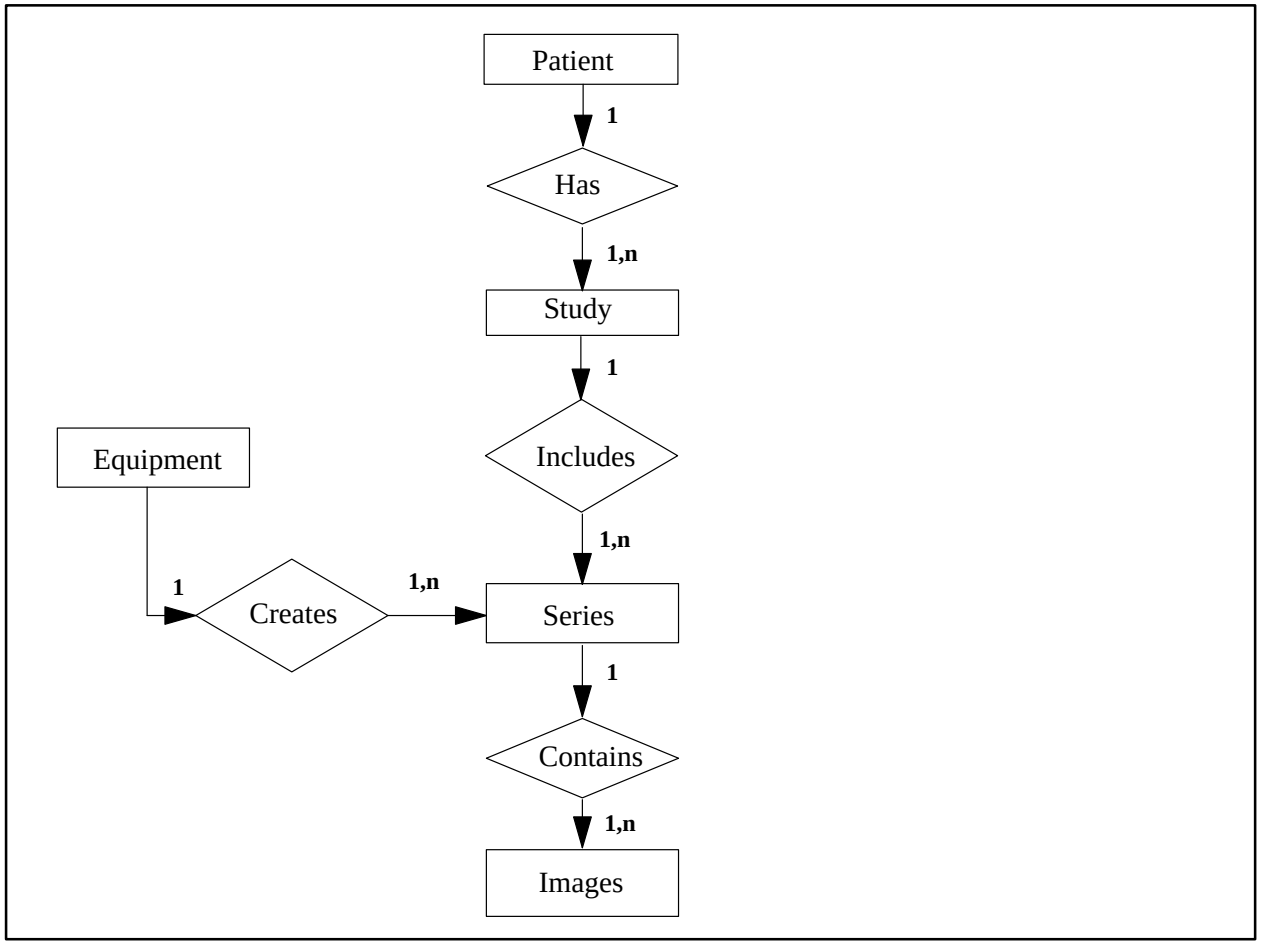
The contents of this section include the following information about the Advanatge CR QA Workstation:

- Image Entity Relationship
- Entity Module Tables
- Information Module Tables

## 3.0 IMAGE ENTITY RELATIONSHIP DIAGRAM

This section specifies the subset of the DICOM CR Image Information Object Definitions (IOD) used to represent the information included in images produced by this implementation. All supported attributes are conveyed with module construct.

ILLUSTRATION 3.0–1




**COMPOSITE IMAGE IOD INFORMATION MODEL**

## 3.1 ENTITY MODULE TABLES FOR IMAGES

### 3.1.1 CR Image IOD Module Table

The following table is a list of modules for the CR Image Storage SOP Class.

TABLE 3.1.1–1 **CR IMAGE INFORMATION OBJECT DEFINITION (IOD) MODULE TABLE**

| Entity Name | Module Name | Usage | Reference |
|---|---|---|---|
| Patient | Patient | M | 3.2.1 |
| Study | General Study | M | 3.2.2 |
| | Patient Study | U | * |
| Series | General Series | M | 3.2.3 |
| | CR Series | M | 3.2.4 |
| Equipment | General Equipment | M | 3.2.5 |
| Image | General Image | M | 3.2.6 |
| | Image Pixel | M | 3.2.9 |
| | Contrast/bolus | C | 3.2.7 |
| | Overlay Plane | U | * |
| | CR Image | M | 3.2.11 |
| | Curve | U | * |
| | CR Image Private Attributes | U** | 3.2.12 |
| | VOI LUT | U | 3.2.8 |
| | Modality LUT | U | * |
| | SOP Common | M | 3.2.10 |

* Not Supported

## 3.2 INFORMATION MODULE DEFINITIONS

This system (DICOM QA Station for FUJI CR) creates CR DICOM IODs. Comments are applicable for Fuji CR Images processed on this system (Advantage CR QA Workstation). Comments are not necessarily applicable for CR Images created on any other system.

### 3.2.1 Patient Module

The following attributes in the Patient Module will be used:

TABLE 3.2.1–1 **PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Patient's Name | (0010,0010) | 2 | * FCR patient name |
| Patient's ID | (0010,0020) | 2 | * FCR patient ID |
| Patient's Birth Date | (0010,0030) | 2 | * FCR birth date |
| Patient's Sex | (0010,0040) | 2 | * FCR sex |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.2 General Study Module

The following attributes in the General Study Module will be used:

TABLE 3.2.2–1 **GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Study Instance UID | (0020,000D) | 1 | * created |
| Study Date | (0008,0020) | 2 | FCR exposure date |
| Study Time | (0008,0030) | 2 | FCR exposure time |
| Referring Physician's Name | (0008,0090) | 2 | Sent zero length |
| Study ID | (0020,0010) | 2 | * FCR exam number, else exposure date |
| Accession Number | (0008,0050) | 2 | * FCR exam number, else exposure date |
| Study Description | (0008,1030) | 3 | FCR menucode string |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.3 General Series Module

The following attributes in the General Series Module will be used:

TABLE 3.2.3–1 **GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Type |
|---|---|---|---|
| Modality | (0008,0060) | 1 | ”CR” |
| Series Instance UID | (0020,000E) | 1 | * created |
| Series Number | (0020,0011) | 2 | FCR menucode (decimal) |
| Laterality | (0020,0060) | 2C | Sent zero length |
| Series Date | (0008,0021) | 3 | FCR exposure date |
| Series Time | (0008,0031) | 3 | FCR exposure time |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.4 CR Series Module

The following attributes in the CR Series Module will be used:

TABLE 3.2.4–1 **CR SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Body Part Examined | (0018,0015) | 2 | FCR menucode string |
| View Position | (0018,5101) | 2 | FCR film exposure info. |

### 3.2.5 General Equipment Module

The following attributes in the General Equipment Module will be used:

TABLE 3.2.6–1 **GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Manufacturer | (0008,0070) | 2 | ”Fuji Photo Film Co. Ltd.” |
| Institution Name | (0008,0080) | 3 | FCR institution name |
| Station Name | (0008,1010) | 3 | hostname–FCR ID |

### 3.2.6 General Image Module

The following attributes in the General Image Module will be used:

TABLE 3.2.8–1 **GENERAL IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Image Number | (0020,0013) | 2 | FCR film number |
| Patient Orientation | (0020,0020) | 2C (3 for CR) | Sent zero length |
| Image Date | (0008,0023) | 2C | * Date image is received from FCR |
| Image Time | (0008,0033) | 2C | * Time image is received from FCR |
| Image Type | (0008,0008) | 3 | ORIGINAL_PRIMARY |
| Acquisition Date | (0008,0022) | 3 | FCR exposure date |
| Acquisition Time | (0008,0032) | 3 | FCR exposure time |
| Image Comments | (0020,4000) | 3 | * FCR menucode string |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.7 Contrast/Bolus Module

The following attributes in Contrast/Bolus Module will be used:

TABLE 3.2.10–1 **CONTRAST/BOLUS MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Contrast/Bolus Agent | (0018,0010) | 2 | Sent zero length |

### 3.2.8 VOI LUT Module

The following attributes in the VOI LUT Module will be used:

TABLE 3.2.11–1 **VOI LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Window Center | (0028,1050) | 3 | * Level |
| Window Width | (0028,1051) | 1C | * Window |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.9 Image Pixel Module

The following attributes in the Image Pixel Module will be used in CR, CT, MR, and SC images:

TABLE 3.2.12–1 **IMAGE PIXEL MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Sample per Pixel | (0028,0002) | 1 | ”1” |
| Photometric Interpretation | (0028,0004) | 1 | ”MONOCHROME2” |
| Rows | (0028,0010) | 1 | * FCR image rows |
| Columns | (0028,0011) | 1 | * FCR image columns |
| Bits Allocated | (0028,0100) | 1 | ”16” |
| Bit Stored | (0028,0101) | 1 | ”10” |
| High Bit | (0028,0102) | 1 | ”9” |
| Pixel Representation | (0028,0103) | 1 | ”0” (unsigned int.) |
| Pixel Data | (7FE0,0010) | 1 | |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.10 SOP Common Module

The following attributes in the SOP Common Module will be used:

TABLE 3.2.13–1 **SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comments |
|---|---|---|---|
| SOP Class UID | (0008,0016) | 1 | 1.2.840.10008.5.1.4.1.1.1 |
| SOP Instance UID | (0008,0018) | 1 | * created |

* May change if image is edited by user of Advantage CR QA Workstation

### 3.2.11 CR Image Module

The following attribute in the CR Image Module will be used:

TABLE 3.2.14–1 **CR IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | Comment |
|---|---|---|---|
| Sensitivity | (0018,6000) | 3 | FCR sensitivity |

### 3.2.12 CR Private Image Attributes

TABLE 3.3.12–1 **CR PRIVATE IMAGE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Attribute Description |
|---|---|---|---|---|---|
| Private Creator | (0023,0010) | 1C | LO | 1 | ”GEMS_ACRQA_1.0 BLOCK1” |
| Private Creator | (0023,0020) | 1C | LO | 1 | ”GEMS_ACRQA_1.0 BLOCK2” |
| Private Creator | (0023,0030) | 1C | LO | 1 | ”GEMS_ACRQA_1.0 BLOCK3” |
| Private Creator | (0023,0040) | 1C | LO | 1 | ”GEMS_ACRQA_1.0 BLOCK4” |
| CR Exposure Menu Code | (0023,1000) | 3 | LO | 1 | FCR exposure menucode |
| CR Exposure Menu String | (0023,1010) | 3 | LO | 1 | FCR exposure menucode string |
| CR EDR Mode | (0023,1020) | 3 | LO | 1 | FCR EDR mode setting |
| CR Latitude | (0023,1030) | 3 | LO | 1 | FCR latitude |

| Attribute Name | Tag | Type | VR | VM | Attribute Description |
|---|---|---|---|---|---|
| CR Group Number | (0023,1040) | 3 | LO | 1 | FCR group number |
| CR Image Serial Number | (0023,1050) | 3 | US | 1 | FCR continuous image number |
| CR Bar Code Number | (0023,1060) | 3 | LO | 1 | FCR barcode number |
| CR Film Output Exposure | (0023,1070) | 3 | LO | 1 | FCR film character string |
| CR Film Format | (0023,1080) | 3 | LO | 1 | FCR film format |
| CR S–Shift String | (0023,1090) | 3 | LO | 1 | * FCR S–Shift String |
| CR S–Shift | (0023,2000) | 3 | US | 1 | * FCR S–Shift value |
| CR C–Shift | (0023,2010) | 3 | DS | 1 | * FCR C–Shift value |
| CR GT | (0023,2020) | 3 | DS | 1 | * FCR GT value |
| CR GA | (0023,2030) | 3 | DS | 1 | * FCR GA value |
| CR GC | (0023,2040) | 3 | DS | 1 | * FCR GC value |
| CR GS | (0023,2050) | 3 | DS | 1 | * FCR GS value |
| CR RT | (0023,2060) | 3 | DS | 1 | * FCR RT value |
| CR RE | (0023,2070) | 3 | DS | 1 | * FCR RE value |
| CR RN | (0023,2080) | 3 | US | 1 | * FCR RN value |
| CR DRT | (0023,2090) | 3 | DS | 1 | * FCR DRT value |
| CR DRE | (0023,3000) | 3 | DS | 1 | * FCR DRE value |
| CR DRN | (0023,3010) | 3 | US | 1 | * FCR DRN value |
| CR ORE | (0023,3020) | 3 | DS | 1 | FCR ORE value |
| CR ORN | (0023,3030) | 3 | US | 1 | FCR ORN value |
| CR ORD | (0023,3040) | 3 | US | 1 | FCR ORD value |
| CR Cassette Size | (0023,3050) | 3 | LO | 1 | FCR imaging plate size code |
| CR Machine ID | (0023,3060) | 3 | LO | 1 | FCR machine ID code |
| CR Machine Type | (0023,3070) | 3 | LO | 1 | FCR machine type string |
| CR Technician Code | (0023,3080) | 3 | LO | 1 | FCR technician code |
| CR ES Parameters | (0023,3090) | 3 | LO | 1 | FCR energy subtraction values |

* May change if image is edited by user of Advantage CR QA Workstation

THIS PAGE LEFT INTENTIONALLY BLANK

# SECTION 4 – ADVANTAGE CR QA DICOM PRINT SCU CONFORMANCE

## 4.0 DICOM PRINT APPLICATION ENTITY SPECIFICATIONS

### 4.0.1 Meta SOP Class Conformance

The Advantage CR QA DICOM Application Entity provides Standard Conformance to the following DICOM V3.0 Meta SOP Class as an SCU:

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Basic Grayscale Print Management Meta | 1.2.840.10008.5.1.1.9 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

### 4.0.2 SOP Specific Conformance

The Advantage CR QA DICOM Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

| SOP Class Name | SOP Class UID |
|---|---|
| Basic Film Session | 1.2.840.10008.5.1.1.1 |
| Basic Film Box | 1.2.840.10008.5.1.1.2 |
| Basic Film Grayscale Image Box | 1.2.840.10008.5.1.1.4 |
| Printer | 1.2.840.10008.5.1.1.16 |

## 4.1 SOP SPECIFIC CONFORMANCE

### 4.1.1 Basic Film Session SOP Class

The Advantage CR QA Workstation supports the following DIMSE Service Elements for the Basic Film Session SOP Class:

**N–CREATE** – creates an instance of the the Basic Film Session SOP Class.
**N–ACTION** – causes the instance of the the Basic Film Session SOP Class to be printed.

The following Basic Film Session SOP Class attributes are supported (Note: All attributes can be individually configured to be not sent in case a DICOM Print SCP can not handle them. See note in section 3.1.5.1 for more details.):

TABLE 4.1.1–1 **BASIC FILM SESSION SOP CLASS ATTRIBUTES**

| Attribute Name | Tag | Range | Default Value |
|---|---|---|---|
| Number of Copies | (2000,0010) | 1–99 | 1 |
| Print Priority | (2000,0020) | HIGH, MED, LOW, | MED |
| Medium Type | (2000,0030) | PAPER, CLEAR FILM, BLUE FILM, CURRENT | CURRENT |
| Film Destination | (2000,0040) | MAGAZINE, PROCESSOR, CURRENT | CURRENT |
| Film Session Label | (2000,0050) | Text string up to 64 characters | ”ACRQA DICOM PRINT” |
| Memory Allocation | (2000,0060) | Value in KB’s | 0 |

### 4.1.2 Basic Film Box SOP Class

The Advantage CR QA Workstation supports the following DIMSE Service Elements for the Basic Film Box SOP Class:

**N–CREATE** – creates an instance of the the Basic Film Box SOP Class.

The following Basic Film Box SOP Class attributes are supported (Note: All attributes can be individually configured to be not sent in case a DICOM Print SCP can not handle them. See note in section 3.1.5.1 for more details.):

TABLE 4.1.2–1 **BASIC FILM BOX SOP CLASS ATTRIBUTES**

| Attribute Name | Tag | Range | Default Value |
|---|---|---|---|
| Image Display Format | (2010,0010) | STANDARD\1,1 | STANDARD\1,1 |
| Film Orientation | (2010,0040) | PORTRAIT | PORTRAIT |
| Film Size ID | (2010,0050) | 8INX10IN, 10INX12IN, 14INX14IN, 14INX17IN, 9.5INX9.5IN, 18CMX24CM, 24CMX30CM, 35CMX35CM, 35CMX43CM | 14INX17IN<br><br>See section 4.2.1 for additional information |
| Magnification Type | (2010,0060) | REPLICATE, BILINEAR, CUBIC, NONE | CUBIC |
| Smoothing Type | (2010,0080) | Printer Dependent, Configurable | 8 |
| Border Density | (2010,0100) | BLACK, WHITE | BLACK |
| Empty Image Density | (2010,0110) | BLACK, WHITE | BLACK |
| Min Density | (2010,0120) | Printer Dependent, Configurable | 0 |
| Max Density | (2010,0130) | Printer Dependent, Configurable | 270 |
| Trim | (2010,0140) | YES, NO | NO |
| Configuration Information | (2010,0150) | Printer Dependent, Configurable | ”NOT SET” |

### 4.1.3 Basic Grayscale Image Box SOP Class

The Advantage CR QA Workstation supports the following DIMSE Service Elements for the Basic Grayscale Image Box SOP Class:

**N–SET** – updates the instance of the Basic Grayscale Image Box SOP Class.

The following Basic Grayscale Image Box SOP Class attributes are supported (Note: All attributes can be individually configured to be not sent in case a DICOM Print SCP can not handle them. See note in section 3.1.5.1 for more details.):

TABLE 4.1..3–1 **BASIC GRAYSCALE IMAGE BOX SOP CLASS ATTRIBUTES**

| Attribute Name | Tag | Range | Default Value |
|---|---|---|---|
| Image Position | (2020,0010) | 1 | 1 |
| Polarity | (2020,0020) | NORMAL, REVERSE | NORMAL |
| Samples Per Pixel | (0028,0002) | 1 | 1 |
| Photometric Implementation | (0028,0004) | MONOCHROME2 | MONOCHROME2 |
| Rows | (0028,0010) | Printer Dependent | Image Dependent |
| Columns | (0028,0011) | Printer Dependent | Image Dependent |
| Pixel Aspect Ratio | (0028,0034) | 1\1 | 1\1 |
| Bits Allocated | (0028,00100) | 8,16 | 16 |
| Bits Stored | (0028,00101) | 8–16 | 10 |
| High Bit | (0028,00102) | 7–15 | 9 |
| Pixel Representation | (0028,00103) | 0 (unsigned integer) | 0 |

### 4.1.4 Printer Sop Class

The Advantage CR QA Workstation supports the following DIMSE Service Elements for the Printer SOP Class:

**N–GET** – retrieves the instance of the the Printer SOP Class.

The following Printer SOP Class attributes are supported

TABLE 4.1.4–1 **PRINTER SOP CLASS ATTRIBUTES**

| Attribute Name | Tag | Response to Status |
|---|---|---|
| Printer Status | (2110,0010) | NORMAL – Print Association Continues<br>WARNING – Print Association Continues<br>FAILURE – Print Association Aborted |
| Printer Status Info | (2110,0020) | ALL – Information Only |
| Printer Name | (2110,0030) | ALL – Information Only |
| Manufacturer | (0008,0070) | ALL – Information Only |
| Manufacturer Model Name | (0008,1090) | ALL – Information Only |
| Device Serial Number | (0018,1000) | ALL – Information Only |
| Software Versions | (0018,1020) | ALL – Information Only |
| Date Last Calibration | (0018,1200) | ALL – Information Only |
| Time Last Calibration | (0018,1201) | ALL – Information Only |

## 4.2 Additional Configuration Information

### 4.2.1 Required Printer Information

The Advantage CR QA Workstation DICOM Print SCU needs additional printer information in order for correct operation. These additional fields are printer dependent and are configured via a DICOM Print Application Entity default configuration file for each printer:

Number of printable rows
Number of printable columns
Pixels per inch

Refer to the Advantage CR QA Workstation Operation Manual and/or Service Manual for more details.

### 4.2.2 Printer Dependent Configuration

All attributes are user configurable via a DICOM Print Application Entity configuration file. The default configuration file is adaptable to each DICOM Print SCP that is configured for the Advantage CR QA Workstation. The files contains a set flag for each attribute and an editable entry for each attribute.

An example is as follows:

SET_BORDER_DENSITY ON/OFF

OFF = Will cause BORDER DENSITY attribute to be not set
ON = Will cause BORDER DENSITY attribute to be set

BORDER_DENSITY Value/No Value

Value = If SET_BORDER_DENSITY is ON, this will cause BORDER DENSITY to be Value
No Value = If SET_BORDER_DENSITY is ON, this will cause BORDER DENSITY to be Default Value listed in above tables
If SET_BORDER_DENSITY is OFF, this entry is ignored and BORDER DENSITY is not set.

Refer to the Advantage CR QA Workstation Operation Manual and/or Service Manual for more details.

### 4.2.3 Additional Print Features

#### 4.2.3.1 Printer Dependent LUT's

The Advantage CR QA DICOM Print Application Entity has the ability to apply a Modality LUT to the Pixel Data before setting the Basic Grayscale Image Box SOP Class. Refer to the Advantage CR QA Workstation Operation Manual and/or Service Manual for more details.

#### 4.2.3.2 Image Size

The Advantage CR QA DICOM Print Application Entity has the ability to modify the image size the Pixel Data before setting the Basic Grayscale Image Box SOP Class. The annotation options are as follows:

*Fit To Film*: Image size is adjusted to use the full size of the film.
*True*: Image is printed at life size.
*Reduced*: Image is printed ate a percentage of life size (default is 67%).

Refer to the Advantage CR QA Workstation Operation Manual and/or Service Manual for more details.

#### 4.2.3.3 Image Annotation

The Advantage CR QA DICOM Print Application Entity has the ability to add image annotation to the Pixel Data before setting the Basic Grayscale Image Box SOP Class. The annotation options are as follows:

*NONE*: No Annotation
*PARTIAL*: Patient Information, Exam Information, and Window/Level Settings
*FULL*: Partial information plus CR specific annotation

Individual annotation fields can be individually controlled as well as the font type and size. Refer to Advantage CR QA Workstation User Manual and/or Service Manual for more details.

THIS PAGE LEFT INTENTIONALLY BLANK

***GE Medical Systems***

*GE Medical Systems: Telex 3797371*
*P.O. Box 414, Milwaukee, Wisconsin 53201 U.S.A.*
*(Asia, Pacific, Latin America, North America)*

*GE Medical Systems — Europe: Telex 261794*
*Shortlands, Hammersmith, London W6 8BX U.K.*