



# *Kodak DirectView* CR 800 and CR 900 Systems

## DICOM Conformance Statement

**CR 800 System 2.2.x**

**CR 900 System 2.1.x**

**June 20, 2001**

**Document # 3E1420**

**Revision G**

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## Revision History

| Date       | Rev | MIMS/<br>W | Editor      | Comments                                                                                  |
|------------|-----|------------|-------------|-------------------------------------------------------------------------------------------|
| 07/14/1999 |     | 3.2.x      | K. Mantooth | Initial release of document for Gate 1.5.                                                 |
| 10/07/1999 | A   | 3.2.x      | K. Mantooth | Incorporate comments and clean-up.                                                        |
| 03/27/2000 | B   | 3.2.b9     | K. Mantooth | Add support for Imation parameters.<br>Remove Annotation Box SOP class. Fix product name. |
| 07/26/2000 | C   | 3.2.b25    | K. Mantooth | Fix typos. Fix Configuration Information examples.                                        |
| 09/28/2000 | D   | 3.2.b31    | K. Mantooth | Clean up trademarks and logo.                                                             |
| 01/17/2001 | E   | 3.5.4      | K. Mantooth | Add CR Image elements, Worklist elements, and Japanese Language character sets.           |
| 03/19/2001 | F   | 3.5.4      | K. Mantooth | Update document to reflect CR900 as well as CR800                                         |
| 06/20/2001 | G   | 3.5.4      | K. Mantooth | Clean up trademarks.                                                                      |

# 0 Introduction

## 0.1 Executive Overview

This document covers the following *Kodak DirectView* CR System products:

- *Kodak DirectView* CR 800 System
- *Kodak DirectView* CR 900 System

The following DICOM SOP Classes are supported:

| SOP Class Name                                  | SOP Class UID             | Service Class Role |
|-------------------------------------------------|---------------------------|--------------------|
| Verification SOP Class                          | 1.2.840.10008.1.1         | SCU, SCP           |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.1.9     | SCU                |
| Modality Worklist Information Model – FIND      | 1.2.840.10008.5.1.4.31    | SCU                |
| Computed Radiography Image Storage              | 1.2.840.10008.5.1.4.1.1.1 | SCU                |

## 0.2 Scope and Field of Application

This document describes the DICOM functionality of the *Kodak DirectView* CR 800 System and the *Kodak DirectView* CR 900 System. The CR 800 is compact laser scanner with a single cassette manual feed system, capable of reading the latent image formed on a storage phosphor imaging plate and producing a digital image. The CR 900 incorporates an autoloader mechanism, which allows the user to place multiple cassettes in the device for unattended processing. Throughout the remainder of this document the term *DirectView* CR shall refer to both the CR 800 and the CR 900 systems.

The *DirectView* CR acts as a DICOM Service Class User (SCU). The *DirectView* CR performs transactions over a TCP/IP network via the DICOM messages exchange protocol. The *DirectView* CR uses *Kodak PACS Link Medical Image Manager V3.5* software is the application software to capture and distribute images and data.

## 0.3 Important Considerations for the Reader

This DICOM Conformance Statement by itself is not sufficient to guarantee successful connectivity between the *DirectView* CR and equipment from other vendors. The following considerations should be made:

- The integration of equipment from different vendors (including Kodak) goes beyond the scope of the DICOM 3.0 standard and the DICOM Conformance Statements from Kodak and other vendors. It is the responsibility of the user (or user's agent) to assess the application

*Kodak DirectView* CR 800/900 System, DICOM Conformance Statement

requirements and to design a solution that integrates Kodak equipment with equipment from other vendors.

- When the comparison of this DICOM Conformance Statement with a DICOM Conformance Statement from another vendor indicates that connectivity should be possible, it is the responsibility of the user (or user's agent) to verify this by carrying out validation tests and to check whether all required functionality (such as cutlines) is met.
- With regard to the future evolution of the DICOM 3.0 standard Eastman Kodak Company reserves the right to make changes to the *Kodak DirectView* CR 800/900 System architecture described in this document. The user (or user's agent) should ensure that any equipment connected via DICOM to *Kodak* equipment also follows the future evolution of the DICOM 3.0 standard. Failure to do so may result in (partial) loss of connectivity.

#### **0.4 Accessing this Conformance Statement on the World Wide Web**

As the *DirectView* CR product changes, changes to this DICOM Conformance Statement are inevitable. To obtain the most recent revision of this DICOM Conformance Statement, access the following URL:

<http://www.kodak.com/US/en/health/dicom/dicom.shtml>

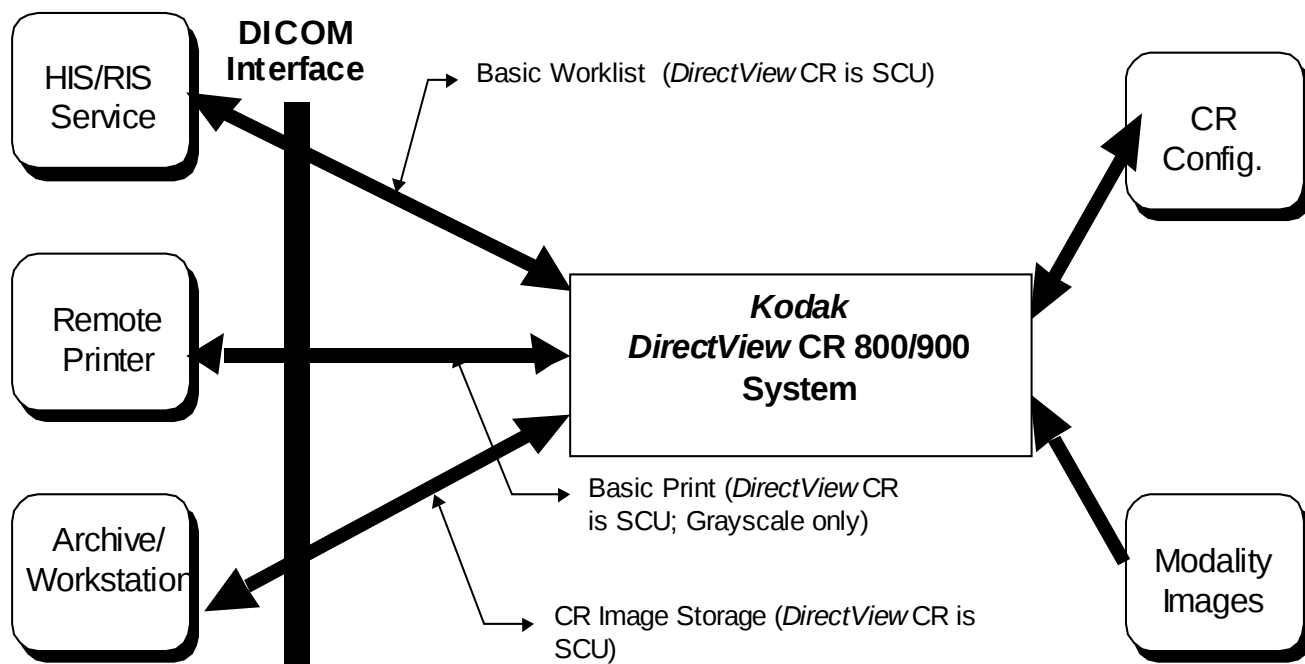
## 0.5 Definitions, Acronyms, Abbreviations

The following symbols and abbreviations are used in this document.

|         |                                                                      |
|---------|----------------------------------------------------------------------|
| ASCII   | American Standard Code for Information Interchange                   |
| AE      | Application Entity                                                   |
| CR      | Computed Radiography                                                 |
| CR 800  | <i>Kodak DirectView</i> CR 800 System                                |
| CR 900  | <i>Kodak DirectView</i> CR 900 System                                |
| DICOM   | Digital Imaging and Communications in Medicine                       |
| DIMSE   | DICOM Message Service Element                                        |
| DMI     | Distributed Medical Imaging                                          |
| ECR     | Electronic Character Recognition                                     |
| ISO     | International Standards Organization                                 |
| LUT     | Look-up Table                                                        |
| MIM     | <i>Kodak</i> PACS Link Medical Image Manager<br>Software Version 3.5 |
| PDU     | Protocol Data Unit                                                   |
| PLUT    | Presentation Look-up Table                                           |
| SCU     | Service Class User                                                   |
| SCP     | Service Class Provider                                               |
| SOP     | Service-Object Pair                                                  |
| TCP/IP  | Transmission Control Protocol/Internet Protocol                      |
| UID     | Unique Identifier                                                    |
| HIS/RIS | Hospital Information System / Radiology Information System.          |

# 1 Implementation Model

This implementation model uses the DICOM Basic Print Management Meta SOP Class to deliver studies to remote printers. The CR Image Storage SOP Class is used to deliver studies to archives. Basic Worklist Management service is used for the acquisition of patient demographics.



## **1.1 Functional Definitions**

The *DirectView* CR acquires images with the laser scanner and acquire demographics via manual entry at a Kodak Remote Operations Panel or utilizing an optional connection to an Information System. Studies are temporarily stored on disk. The images are then sent to the selected destinations.

## **1.2 Sequencing of Real-World Activities**

If a HIS/RIS service is present, the *DirectView* CR establishes an association when the *DirectView* CR application is started to obtain a modality worklist. The worklist is used as a source of patient demographics. The *DirectView* CR establishes an association with a selected SCP when *DirectView* CR has collected sufficient information to begin sending images.

## 2 Application Entity Specifications

The *DirectView* CR provides Standard Conformance to the following SOP Classes as an SCU.

| SOP Class Name                                     | SOP Class UID             |
|----------------------------------------------------|---------------------------|
| Verification SOP Class                             | 1.2.840.10008.1.1         |
| Basic Grayscale Print Management Meta<br>SOP Class | 1.2.840.10008.5.1.1.9     |
| Modality Worklist<br>Information Model – FIND      | 1.2.840.10008.5.1.4.31    |
| Computed Radiography Image Storage                 | 1.2.840.10008.5.1.4.1.1.1 |

The *DirectView* CR provides Standard Conformance to the following SOP Classes as a SCP.

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

### 2.1 Association Establishment Policies

#### 2.1.1 General

##### 2.1.1.1 Delivery

An Association may be attempted whenever a valid destination is selected and at least one image has been acquired.

The maximum PDU size which the *DirectView* CR will negotiate is 64Kbytes.

##### 2.1.1.2 HIS/RIS

An Association for Basic Worklist will be attempted when the *DirectView* CR application is started and then periodically thereafter.

#### 2.1.2 Number of Associations

##### 2.1.2.1 Delivery

Associations are initiated with the limitation that no more than three total SCU delivery associations may be open at any given time. If more destinations are desired, the requests are queued. The *DirectView* CR will not create two associations to the same device, even if there are multiple jobs queued for delivery.

### **2.1.2.2 HIS/RIS**

Only one association will be initiated at a time. The *DirectView* CR will close the association after receiving a C-FIND response.

### **2.1.3 Asynchronous Nature**

The *DirectView* CR allows up to 1 invoked and 1 performed operation on an Association (it is synchronous).

### **2.1.4 Implementation Identifying Information**

The *DirectView* CR provides the Implementation Class UID of “1.2.840.113564.3.1.3”.

The implementation version name attribute is optional and is not used by the *DirectView* CR.

The *DirectView* CR establishes an Association using its network node name for the calling DICOM Application Entity title. The network node name is configurable through the *DirectView* CR Service Application.

The *DirectView* CR stores a called DICOM Application Entity Title and socket number for each DICOM compatible network destination it knows about.

## **2.2 Association Initiation Policy**

### **2.2.1 Associated Real-World Activity**

#### **2.2.1.1 Delivery**

The *DirectView* CR initiates Associations for the purpose of sending images and associated information for printing to a Basic Grayscale Print Management SCP and archiving to an SC Image Storage SCP.

The default well-known socket 5040 will be used for making the Association unless a different one is configured by a product service provider.

#### **2.2.1.2 HIS/RIS**

The *DirectView* CR initiates Associations for the purpose of obtaining the current Modality Worklist IOD.

## 2.2.2 Presentation Context Table

The *DirectView* CR proposes the Presentation Contexts shown below.

| Presentation Context Table         |                           |                                 |                   |      |            |
|------------------------------------|---------------------------|---------------------------------|-------------------|------|------------|
| Abstract Syntax                    |                           | Transfer Syntax                 |                   | Role | Ext. Negot |
| Name                               | UID                       | Name List                       | UID               |      |            |
| Verification                       | 1.2.840.10008.1.1         | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU  | None       |
| 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       |
| Modality Worklist                  | 1.2.840.10008.5.1.4.31    | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU  | None       |
| Computed Radiography Image Storage | 1.2.840.10008.5.1.4.1.1.1 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU  | None       |

## 2.2.3 SOP Specific Conformance

### 2.2.3.1 Verification

The *DirectView* CR provides standard conformance to the DICOM Verification Service Class. When prompted by a user, the *DirectView* CR will request verification of communication to a remote DICOM AE using the C-ECHO primitive.

### 2.2.3.2 Delivery

Association attempts will be retried if the SCP rejects the request with the RESULT = 2 (rejected transient) and the REASON = 1 (temporary congestion). If all Association attempts fail, then the user will be notified and the Film Session or Study is saved for resending or deletion. No undelivered image files are deleted without manual user direction.

### 2.2.3.3 HIS/RIS

The *DirectView* CR will poll the HIS/RIS broker in 2 minute cycles and asynchronously on demand from the user.

## 2.3 Association Acceptance Policy

### 2.3.1 Associated Real-World Activity

### 2.3.2 Presentation Context Table

The *DirectView* CR proposes the Presentation Contexts shown below.

| Presentation Context Table |                   |                                 |                   |      |            |
|----------------------------|-------------------|---------------------------------|-------------------|------|------------|
| Abstract Syntax            |                   | Transfer Syntax                 |                   | Role | Ext. Negot |
| Name                       | UID               | Name List                       | UID               |      |            |
| Verification               | 1.2.840.10008.1.1 | DICOM Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP  | None       |

### 2.3.3 SOP Specific Conformance

#### 2.3.3.1 Verification

The *DirectView* CR provides standard conformance to the DICOM Verification Service Class. Upon receipt from an SCU of a verification of communication request, the *DirectView* CR will issue confirmation.

## 2.4 Basic Print Management Meta SOP Class

The Meta SOP Class is defined by the following set of supported SOP Classes:

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

## 2.4.1 Basic Film Session SOP Class

### 2.4.1.1 DIMSE Service N-CREATE

| Attribute          | SCU Usage | Tag         | Possible Values                             |
|--------------------|-----------|-------------|---------------------------------------------|
| Number of Copies   | U         | (2000,0010) | 1 -> 99                                     |
| Print Priority     | U         | (2000,0020) | HIGH, MED, LOW                              |
| Medium Type        | U         | (2000,0030) | PAPER, CLEAR FILM, BLUE FILM, NONE          |
| Film Destination   | U         | (2000,0040) | MAGAZINE, PROCESSOR, BIN_n (where n=1 to 9) |
| Film Session Label | U         | (2000,0050) | Up to 64 characters may be provided         |
| Memory Allocation  | U         | (2000,0060) | Not used                                    |

### 2.4.1.2 DIMSE Service N-Action

The *DirectView* CR uses the N-ACTION to instruct the SCP to print all films in the session. The *DirectView* CR is configurable (when the destination is installed) to issue the N-ACTION at the Film Session for destinations known to support this optional service. If the destination is not known to support collation, the *DirectView* CR will only issue the N-ACTION on the Film Box. For Print SCPs that conform to the N-ACTION specification in Part 4 section H.4.1.2.4 of the DICOM standard, the *DirectView* CR expects that all film boxes will be collated when printed.

### 2.4.1.3 DIMSE Service N-SET

All attributes supported in the N-CREATE are used with this command.

### 2.4.1.4 DIMSE Service N-DELETE

Once a Film Session is deleted, another will not be created on the same association. The Association will be released.

## 2.4.2 Basic Film Box SOP Class

### 2.4.2.1 DIMSE Service N-CREATE

| Attribute                        | SCU Usage | Tag         | Possible Values                                                                                                           |
|----------------------------------|-----------|-------------|---------------------------------------------------------------------------------------------------------------------------|
| Image Display Format             | M         | (2010,0010) | STANDARD\C,R<br>For LANDSCAPE Film Orientation, (C,R) may = (1,1)<br><br>For PORTRAIT Film Orientation, (C,R) may = (1,1) |
| Referenced Film Session Sequence | M         | (2010,0500) |                                                                                                                           |

|                                          |   |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------|---|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| >Referenced SOP Class UID                | M | (0008,1150) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >Referenced SOP Instance UID             | M | (0008,1155) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Referenced Basic Image Box Sequence      | - | (2010,0510) | Not used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Referenced Basic Annotation Box Sequence | - | (2010,0520) | Not used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Film Orientation                         | U | (2010,0040) | PORTRAIT, LANDSCAPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Film Size ID                             | U | (2010,0050) | 4INX6IN<br>8INX10IN<br>85INX11IN (represents 8.5 in. x 11 in.)<br>11INX11IN<br>11INX14IN<br>14INX14IN<br>14INX17IN<br>A4                                                                                                                                                                                                                                                                                                                                                                                                           |
| Magnification Type                       | U | (2010,0060) | REPLICATE, BILINEAR, CUBIC, NONE<br><br>Will be constant for the entire Film Box.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Max Density                              | U | (2010,0130) | 0-399 (Value will be within the active calibration range of the Printer and will be less than or equal to the Border Density (2010,0080))                                                                                                                                                                                                                                                                                                                                                                                          |
| Configuration Information                | U | (2010,0150) | <i>Kodak Curve Shape (CS):</i><br>000 to 999<br><br><i>Kodak Contrast Values (CN):</i><br>-1 to -5 Lower contrast<br>0 Normal<br>+1 to +5 Higher contrast<br><br><i>Kodak Pivot Density (PD):</i><br>0 to 2.4 in increments of 0.2<br><br><i>Perception LUT Selection (LUT):</i><br>LUT = m, n (m=string, n = 0 to 15)<br><br><i>Kodak Text Macros (TM):</i><br>%PRNTDAT%, %TIM%, %FOF%,<br>%\$TIMES\$, %SES%<br><br>Perception LUT cannot be used with Curve Shape, Contrast or Pivot Density.<br><br>See Annex A for description |
| Annotation Display Format ID             | U | (2010,0030) | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Smoothing Type                           | U | (2010,0080) | NORMAL (minimum cubic convolution error)<br>ENHANCED<br>ENHANCED1<br>Valid only for Magnification Type CUBIC.<br><br>0-15                                                                                                                                                                                                                                                                                                                                                                                                          |
| Border Density                           | U | (2010,0100) | BLACK, WHITE, i, where i may = 1-399 (If integer value specified, value must be greater than or equal to Max Density (2010,0130))                                                                                                                                                                                                                                                                                                                                                                                                  |
| Empty Image Density                      | U | (2010,0110) | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Min Density                              | U | (2010,0120) | 0-399 (Value must be less than Max Density (2010,0130))                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                          |    |             |                                                |
|--------------------------|----|-------------|------------------------------------------------|
| Illumination             | MC | (2010,015E) | Positive integer in units of cd/m <sup>2</sup> |
| Reflective Ambient Light | MC | (2010,0160) | Positive integer in units of cd/m <sup>2</sup> |
| Trim                     | U  | (2010,0140) | YES and NO                                     |

#### **2.4.2.2 DIMSE Service N-ACTION**

The *DirectView* CR uses the N-ACTION to instruct the SCP to print the current film in the session.

#### **2.4.2.3 DIMSE Service N-SET**

This service is not used.

#### **2.4.2.4 DIMSE Service N-DELETE**

This service is not used.

## 2.4.3 Basic Image Box SOP Class

### 2.4.3.1 DIMSE Service N-SET

| Attribute & Usage                     | SCU Usage | Tag         | Supported Values                                                                                                                                                                                      |
|---------------------------------------|-----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Image Position                        | M         | (2020,0010) | All values within the range of Image Display Format                                                                                                                                                   |
| Preformatted Grayscale Image Sequence | M         | (2020,0110) |                                                                                                                                                                                                       |
| >Samples Per Pixel                    | M         | (0028,0002) | 1                                                                                                                                                                                                     |
| >Photometric Interpretation           | M         | (0028,0004) | MONOCHROME1, MONOCHROME2                                                                                                                                                                              |
| >Rows                                 | M         | (0028,0010) | Minimum Value 64<br>Maximum Values:<br>Known for all Kodak printers, configurable for others. The aspect ratio is used with the printer's page extents, display format, etc. to calculate this value. |
| >Columns                              | M         | (0028,0011) | Minimum Value 64<br>Maximum Values:<br>Known for all Kodak printers, configurable for others. The aspect ratio is used with the printer's page extents, display format, etc. to calculate this value. |
| >Pixel Aspect Ratio                   | MC        | (0028,0034) | R\C<br>R, C = 1 to 9999 (Integer)<br><b>Note:</b> This attribute is always included, even if it is 1\1. It's value will always be 1\1 if Magnification Type is NONE                                   |
| >Bits Allocated                       | M         |             | 16                                                                                                                                                                                                    |
| >Bits Stored                          | M         | (0028,0101) | 12                                                                                                                                                                                                    |
| >High Bit                             | M         | (0028,0102) | Bits Stored -1                                                                                                                                                                                        |
| >Pixel Representation                 | M         | (0028,0103) | 0000H (unsigned integer)                                                                                                                                                                              |
| >Pixel Data                           | M         | (7FE0,0010) | All values consistent with Bits Stored                                                                                                                                                                |
| Polarity                              | U         | (2020,0020) | NORMAL, REVERSE                                                                                                                                                                                       |
| Magnification Type                    | U         | (2010,0060) | REPLICATE, BILINEAR, CUBIC,NONE<br><b>Note:</b> Is always the same as the Magnification Type specified for the Film Box.                                                                              |
| Smoothing Type                        | U         | (2010,0080) | NORMAL, ENHANCED, ENHANCED1<br>Valid only for Magnification Type CUBIC.<br>0-15<br>Must be the same as the Smoothing Type specified for the Film Box.                                                 |

|                                      |   |             |                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------|---|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration Information            | U | (2010,0150) | Setting these values will override film box settings for this image position.<br><br><i>Kodak</i> Curve Shape (CS):<br>000 to 999<br><br>Perception LUT Selection (LUT):<br>LUT = m, n (m=string, n = 0 to 15)<br><br>Curve Shape and Perception LUT are mutually exclusive.<br><br>See Annex A for description |
| Requested Image Size                 | U | (2020,0030) | Row length in mm up to the size of the printable image, which is a function of Image Display Format and Film Size ID.                                                                                                                                                                                           |
| Referenced Presentation LUT Sequence | U | (2020,0030) |                                                                                                                                                                                                                                                                                                                 |
| >SOP Class UID                       | U | (0008,1150) |                                                                                                                                                                                                                                                                                                                 |
| >SOP Instance UID                    | U | (0008,1155) |                                                                                                                                                                                                                                                                                                                 |

## 2.4.4 Printer SOP Class

### 2.4.4.1 DIMSE Service N-EVENT-REPORT

The *DirectView* CR will process the indication of the N-EVENT-REPORT operation. Any string sent by the SCP is accepted and displayed on the *DirectView* CR user interface. In this translation, all characters that are not space characters or in the ASCII range “A” - “Z” are stripped.

The *DirectView* CR translates Attributes as described in the following table. Other strings are not translated but may be displayed on a *DirectView* CR user interface.

| Attribute           | SCU Usage | Tag         | Expected Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|-----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Printer Status      | U         | (2110,0010) | NORMAL<br>WARNING<br>FAILURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Printer Status Info | U         | (2110,0020) | for NORMAL conditions:<br>“NORMAL”<br>for WARNING conditions:<br>“RECEIVER FULL”,<br>“FILM JAM”,<br>“PRINTER NOT RDY”,<br>“PROCESSOR DOWN”,<br>“CHECK PROCESSOR”,<br>“PROC NOT READY”,<br>“NO RECEIVE MGZ”,<br>“NO SUPPLY MGZ”,<br>“NO TONER”,<br>“NO STATE”,<br>“CHECK RIBBON”,<br>“PRINTER BUSY”,<br>“OFFLINE”,<br>“PRINTER STOPPED”,<br>“CHECK SUPPLY MAG”,<br>“COVER OPEN”,<br>“PRINTER OFFLINE”,<br>“EXPOSURE FAILURE”,<br>“CHECK R MAG”,<br>“PROC NOT RDY”,<br>“STATE UNKNOWN”,<br>“CHECK INK CART”,<br>“INK OUT”,<br>“QUEUED”,<br>“SUPPLY EMPTY”,<br>“SUPPLY LOW”,<br>“BAD RECEIVE MGZ”,<br>“BAD SUPPLY MGZ”,<br>“FILM TRANSP ERR”,<br>“CHECK CHEMISTRY”,<br>“CHECK SORTER”,<br>“CHEMICALS LOW”,<br>“CHEMICALS EMPTY”, |

|                                                       |   |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------|---|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Printer Status Info<br>(continued from previous page) |   |             | "FINISHER EMPTY",<br>"FINISHER ERROR",<br>"FINISHER LOW",<br>"CHECK PROC",<br>"PRINTER BUSY",<br>"PROC DOWN",<br>"PROC INIT",<br>"PROC OVERFLOW FL",<br>"PROC OVERFLOW HI",<br>"PRINTER DOWN",<br>"PRINTER INIT",<br>"CALIBRATING",<br>"CALIBRATION ERR",<br>"ELEC CONFIG ERR",<br>"ELEC DOWN",<br>"ELEC SW ERROR",<br>"EXPOSURE FAILURE",<br>"REQ MED NOT INST",<br>"REQ MED NOT AVAI",<br>"RIBBON ERROR",<br>"NO RIBBON",<br>"UNKNOWN"<br><br>for FAILURE conditions:<br>"FATAL",<br>"INVALID PAGE DES",<br>"INSUFFIC MEMORY",<br>"FATAL ERROR",<br>"CHECK PRINTER",<br>"NO RESPONSE",<br>"RIBBON MISMATCH",<br>"TIME OUT",<br>"UNKNOWN STATUS" |
| Printer Name                                          | U | (2110,0030) | Any valid string                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Printer Manufacturer                                  | U | (0008,0070) | Any valid string                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Printer Manufacturer Model Name                       | U | (0008,1090) | Any valid string                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Printer Device Serial Number                          | U | (0018,1000) | Any valid string                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Software Version                                      | U | (0018,1020) | Any valid string                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Date of Last Calibration                              | U | (0018,1200) | Ignored                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Time of Last Calibration                              | U | (0018,1201) | Ignored                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## 2.5 Store Service Class

Computed Radiography Images are sent to the CR Storage SCP.

### 2.5.1 Computed Radiography IOD

The IOD sent from the *DirectView* CR minimally contains the following attributes:

| Attribute Name                  | Tag                              | DICOM Type | DirectView CR Type |
|---------------------------------|----------------------------------|------------|--------------------|
| <b>Patient Module</b>           |                                  |            |                    |
| Patient Name                    | (0010,0010)                      | 2          | 2                  |
| Patient ID                      | (0010,0020)                      | 2          | 2                  |
| Patient Birth Date              | (0010,0030)                      | 2          | 2                  |
| Patient Sex                     | (0010,0040)                      | 2          | 2                  |
| Referenced Patient Sequence     | (0008,1120)                      | 3          | 3                  |
| >Referenced SOP Class UID       | (0008,1150)                      | 1C         | 1C                 |
| >Referenced SOP Instance UID    | (0008,1155)                      | 1C         | 1C                 |
| Patient Birth Time              | (0010,0032)                      | 3          | 3                  |
| Other Patient IDs               | (0010,1000)                      | 3          | 3                  |
| Other Patient Names             | (0010,1001)                      | 3          | 3                  |
| Ethnic Group                    | (0010,2160)                      | 3          | 3                  |
| Patient Comments                | (0010,4000)                      | 3          | 3                  |
| <b>General Study</b>            |                                  |            |                    |
| Study Instance UID              | (0020,000D)                      | 1          | 1                  |
| Study Date                      | (0008,0020)                      | 2          | 2                  |
| Study Time                      | (0008,0030)                      | 2          | 2                  |
| Referring Physician Name        | (0008,0090)                      | 2          | 2                  |
| Study ID                        | (0020,0010)                      | 2          | 2                  |
| Accession Number                | (0008,0050)                      | 2          | 2                  |
| Study Description               | (0008,1030)                      | 3          | 3                  |
| Referenced Study Sequence       | (0008,1110)                      | 3          | 3                  |
| >Referenced SOP Class UID       | (0008,1150)                      | 1C         | 1C                 |
| >Referenced SOP Instance UID    | (0008,1155)                      | 1C         | 1C                 |
| <b>Patient Study</b>            |                                  |            |                    |
| Admitting Diagnoses Description | (0008,1080){xe<br>"(0028,0034)"} | 3          | 3                  |
| Patient's Age                   | (0010,1010){xe<br>"(0028,0034)"} | 3          | 3                  |
| Patient's Size                  | (0010,1020){xe<br>"(0028,0034)"} | 3          | 3                  |

|                                       |                                  |    |    |
|---------------------------------------|----------------------------------|----|----|
| Patient's Weight                      | (0010,1030){xe<br>"(0028,0034)"} | 3  | 3  |
| Occupation                            | (0010,2180){xe<br>"(0028,0034)"} | 3  | 3  |
| Additional Patient's History          | (0010,21B0){xe<br>"(0028,0034)"} | 3  | 3  |
| <b>General Series</b>                 |                                  |    |    |
| Modality                              | (0008,0060)                      | 1  | 1  |
| Series Instance UID                   | (0020,000E)                      | 1  | 1  |
| Series Number                         | (0020,0011)                      | 2  | 2  |
| Laterality                            | (0020,0060)                      | 2C | 2C |
| Series Date                           | (0008,0021)                      | 3  | 3  |
| Series Time                           | (0008,0031)                      | 3  | 3  |
| Series Description                    | (0008,103E)                      | 3  | 3  |
| Operator Name                         | (0008,1070)                      | 3  | 3  |
| Patient Position                      | (0018,5100)                      | 2C | 2C |
| Request Attributes Sequence           | (0040,0275)                      | 3  | 3  |
| >Requested Procedure ID               | (0040,1001)                      | 1C | 1C |
| >Scheduled Procedure Step ID          | (0040,0009)                      | 1C | 1C |
| >Scheduled Procedure Step Description | (0040,0007)                      | 3  | 3  |
| >Scheduled Action Item Code Sequence  | (0040,0008)                      | 3  | 3  |
| >>Code Value                          | (0040,0100)                      | 1C | 1C |
| >>Code Scheme Designator              | (0040,0102)                      | 1C | 1C |
| >>Code Meaning                        | (0040,0104)                      | 3  | 3  |
| <b>CR Series</b>                      |                                  |    |    |
| Body Part Examined                    | (0018,0015)                      | 2  | 2  |
| View Position                         | (0018,5101)                      | 2  | 2  |
| Phosphor Type                         | (0018,1261)                      | 3  | 3  |
| <b>General Equipment</b>              |                                  |    |    |
| Manufacturer                          | (0008,0070)                      | 2  | 2  |
| Institution Name                      | (0008,0080)                      | 3  | 3  |
| Institution Address                   | (0008,0081)                      | 3  | 3  |
| Station Name                          | (0008,1010)                      | 3  | 3  |
| Institutional Department Name         | (0008,1040)                      | 3  | 3  |
| Manufacturer Model Name               | (0008,1090)                      | 3  | 3  |
| Device Serial Number                  | (0018,1000)                      | 3  | 3  |
| Software Versions                     | (0018,1020)                      | 3  | 3  |

|                            |                                  |    |    |
|----------------------------|----------------------------------|----|----|
| <b>General Image</b>       |                                  |    |    |
| Image Number               | (0020,0013)                      | 2  | 2  |
| Patient Orientation        | (0020,0020)                      | 2C | 2  |
| Image Date                 | (0008,0023)                      | 2C | 2C |
| Image Time                 | (0008,0033)                      | 2C | 2C |
| Acquisition Date           | (0008,0022)                      | 3  | 3  |
| Acquisition Time           | (0008,0032)                      | 3  | 3  |
| Images In Acquisition      | (0020,1002)                      | 3  | 3  |
| Image Comments             | (0020,4000)                      | 3  | 3  |
| <b>Image Plane *</b>       |                                  |    |    |
| Pixel Spacing *            | (0028,0030){xe<br>"(0028,0002)"} | 3  | 3  |
| <b>Image Pixel</b>         |                                  |    |    |
| Samples per Pixel          | (0028,0002){xe<br>"(0028,0002)"} | 1  | 1  |
| Photometric Interpretation | (0028,0004){xe<br>"(0028,0004)"} | 1  | 1  |
| Rows                       | (0028,0010){xe<br>"(0028,0010)"} | 1  | 1  |
| Columns                    | (0028,0011){xe<br>"(0028,0011)"} | 1  | 1  |
| Bits Allocated             | (0028,0100){xe<br>"(0028,0100)"} | 1  | 1  |
| Bits Stored                | (0028,0101){xe<br>"(0028,0101)"} | 1  | 1  |
| High Bit                   | (0028,0102){xe<br>"(0028,0102)"} | 1  | 1  |
| Pixel Representation       | (0028,0103){xe<br>"(0028,0103)"} | 1  | 1  |
| Pixel Data                 | (7FE0,0010){xe<br>"(7FE0,0010)"} | 1  | 1  |
| Planar Configuration       | (0028,0006){xe<br>"(0028,0006)"} | 1C | 1C |
| Pixel Aspect Ratio         | (0028,0034){xe<br>"(0028,0034)"} | 1C | 1C |
| <b>CR Image</b>            |                                  |    |    |
| KVP                        | (0018,0060)                      | 3  | 3  |
| Plate ID                   | (0018,1004)                      | 3  | 3  |
| Distance Source to Patient | (0018,1111)                      | 3  | 3  |
| Exposure                   | (0018,1152)                      | 3  | 3  |

|                         |                                  |    |    |
|-------------------------|----------------------------------|----|----|
| Cassette Orientation    | (0018,1402)                      | 3  | 3  |
| Cassette Size           | (0018,1403)                      | 3  | 3  |
| Relative X-Ray Exposure | (0018,1405)                      | 3  | 3  |
| Imager Pixel Spacing    | (0018,1164)                      | 3  | 3  |
| <b>Contrast/Bolus</b>   |                                  |    |    |
| Contrast/Bolus Agent    | (0018,0010){xe<br>"(0028,0034)"} | 2  | 2  |
| <b>Modality LUT</b>     |                                  |    |    |
| Modality LUT Sequence   | (0028,3000)                      | 3  | 3  |
| >LUT Descriptor         | (0028,3002)                      | 1C | 1C |
| >LUT Explanation        | (0028,3003)                      | 3  | 3  |
| >Modality LUT Type      | (0028,3004)                      | 1C | 1C |
| >LUT Data               | (0028,3006)                      | 1C | 1C |
| Rescale Intercept       | (0028,1052)                      | 1C | 1C |
| Rescale Slope           | (0028,1053)                      | 1C | 1C |
| Rescale Type            | (0028,1054)                      | 1C | 1C |
| <b>VOI LUT</b>          |                                  |    |    |
| Window Center           | (0028,1050)                      | 3  | 3  |
| Window Width            | (0028,1051)                      | 1C | 1C |
| <b>SOP Common</b>       |                                  |    |    |
| SOP Class UID           | (0008,0016)                      | 1  | 1  |
| SOP Instance UID        | (0008,0018)                      | 1  | 1  |
| Specific Character Set  | (0008,0005)                      | 1C | 1C |
| Instance Creation Date  | (0008,0012)                      | 3  | 3  |
| Instance Creation Time  | (0008,0013)                      | 3  | 3  |
| Instance Creator UID    | (0008,0014){xe<br>"(0028,0034)"} | 3  | 3  |

\* The *DirectView* CR optionally allows the Pixel Spacing attribute to be used. This is done to support workstations which incorrectly use this field rather than Imager Pixel Spacing, as defined in the DICOM standard. If this field is used, the actual size of any objects displayed on the workstation (scales, etc.) may be in error. Since the Image Plane module is not normally a part of CR Store, Pixel Spacing is the only attribute included.

## 2.6 Basic Worklist Service

The C-FIND request for a Modality Worklist sends an Identifier object that contains all the attributes of the Modality Worklist Information Model. The Matching Key attributes that may

optionally contain a non-NULL value in the request are:

- (0040,0001) Scheduled Station AE Title
- (0040,0002) Scheduled Procedure Step Start Date
- (0040,0003) Scheduled Procedure Step Start Time
- (0040,0007) Scheduled Procedure Step Description
- (0040,0010) Scheduled Station Name
- (0008,0050) Accession Number
- (0010,0010) Patient's Name
- (0010,0020) Patient ID
- (0008,0060) Modality

This is intended to produce a series of responses from the Worklist SCP for all matching Scheduled Procedures on the said Station.

### 2.6.1 Modality Worklist IOD

For additional information on the Modality Worklist Information Model, refer to the DICOM specification, Part 4, Table K.6-1. The *DirectView* CR will only accept the ISO registration number ISO-IR 6 or ISO-IR 100 character sets for the Specific Character Set attribute (0008,0005).

#### ATTRIBUTES FOR THE MODALITY WORKLIST INFORMATION MODEL

| Attribute                           | Tag         |
|-------------------------------------|-------------|
| Accession Number                    | (0008,0050) |
| Modality                            | (0008,0060) |
| Referring Physicians Name           | (0008,0090) |
| Patients Name                       | (0010,0010) |
| Patient ID                          | (0010,0020) |
| Patients Birth Date                 | (0010,0030) |
| Patients Birth Time                 | (0010,0032) |
| Patients Sex                        | (0010,0040) |
| Other Patient Ids                   | (0010,1000) |
| Other Patient Names                 | (0010,1001) |
| Patients Age                        | (0010,1010) |
| Patients Size                       | (0010,1020) |
| Patients Weight                     | (0010,1030) |
| Ethnic Group                        | (0010,2160) |
| Occupation                          | (0010,2180) |
| Study Instance UID                  | (0020,000D) |
| Requesting Service                  | (0032,1033) |
| Requested Procedure Description     | (0032,1060) |
| Requested Contrast Agent            | (0032,1070) |
| Visit Status ID                     | (0038,0008) |
| Patients Institution Residence      | (0038,0400) |
| Scheduled Station AE Title          | (0040,0001) |
| Scheduled Procedure Step Start Date | (0040,0002) |
| Scheduled Procedure Step Start Time | (0040,0003) |
| Scheduled Station Name              | (0040,0010) |
| Requested Procedure Priority        | (0040,1003) |
| Requested Procedure Location        | (0040,1005) |

## 3 Communication Profiles

### 3.1 Supported Communications Stacks

The *DirectView* CR provides TCP/IP Network Communication Support as defined in Part 8 of the DICOM standard.

### 3.2 Physical Media

The *DirectView* CR supports Ethernet with the following physical connectors:

- Unshielded Twisted pair (10BaseT and 100BaseT).

## 4 Extensions/Specializations/Privateizations

The following extensions to DICOM Store Service Class are supported by *DirectView* CR. The extensions are all optional attributes.

### Computed Radiography IOD:

The *DirectView* CR optionally allows the Pixel Spacing (0028,0030) attribute to be used from the Image Plane Module. This is done to support workstations which incorrectly use this field rather than Imager Pixel Spacing (0018,1164), as defined in the DICOM standard. If this field is used, the actual size of any objects displayed on the workstation (scales, etc.) may be in error.

Since the Image Plane module is not normally a part of CR Store, Pixel Spacing is the only attribute included.

## 5 Configuration

The following network attributes are configurable by a qualified service provider:

- IP address
- Subnet Mask
- Local Network Host Name (*DirectView* CR AE Title)
- SCP DICOM Called Application Entity Title
- Socket number
- Router Address (Gateway)
- DICOM Service(s) available
- Film Sizes available
- Other destination properties

## 6 Support of Extended Character Sets

The *DirectView* CR supports the ISO-IR 100 Latin 1 character set as well as the ISO-IR 6 default character set.

The *DirectView* CR also supports the ISO-IR 87 character set. This is part of the JIS X 0208 code table for 2-byte Japanese character sets which supports Kanji (ideograph), Hiragana (phonetic), and Katakana (phonetic).

The *DirectView* CR also supports the ISO-IR 13 character set. This is part of the JIS X 0201 code table for single-byte Japanese Katakana (phonetic) characters.

The value set in the tag Specific Character Set (0008,0005) will be either:

- a) “ISO\_IR 100” (Latin 1),
- b) “ISO\_IR 13” (Katakana),
- c) “ISO 2022 IR 13ISO 2022 IR 87” (Katakana, Hiragana, Kanji),
- d) or blank (ISO-IR 6 is the default character set).

## 7 Error Handling

The *DirectView* CR has limited recovery from communication errors. Some specific warnings will be logged locally and communication will continue. All other DICOM status codes (warning or error) will result in an aborted session (A-ABORT sent).

Codes that will NOT cause A-ABORT:

|        |                                                                       |
|--------|-----------------------------------------------------------------------|
| 0x0000 | SUCCESS                                                               |
| 0xb602 | Film session does not contain Image                                   |
| 0xb603 | Film Box does not contain Image                                       |
| 0x0210 | Duplicate Invocation                                                  |
| 0x0107 | Attribute List Error. Interpreted as Value out of range, default used |
| 0x0116 | Attribute value is out of range, default used.                        |

## Annex A - Configuration Information

The Configuration Information attribute contains the list of *Kodak*-specific values. These attributes are not DICOM standard attributes.

The Configuration Information value is an ordered list. The attribute is specified using the ASCII two-character key prefix in the following sequence:

- 1) Curve Shape, Contrast, Pivot Density  
or Perception LUT
- 2) Text Macros.

The Film Box Curve Shape value applies to all images in the Film Box except when Curve Shape or Perception LUT is specified for the image in the Image Box.

| ATTRIBUTE                                                                   | USAGE | DESCRIPTION                                                                                                                                                                                                                                                                                                         | DEFAULT                                                                                                 |
|-----------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Curve Shape<br>designated by the<br>ASCII two-<br>character prefix:<br>CS   | U/M   | 000 to 999<br><br><b>Note:</b> 000 = linear, 999 = highest curvature<br><br>Curve Shape is a tone scale adjustment used to optimize the image on film compared to the image on the operator console monitor. Curve shape is not valid when a Perception LUT is specified.                                           | Film Box:<br>Value set in the<br>Printer by the user<br><br>Image Box:<br>Basic Film Box<br>Curve Shape |
| Contrast<br>designated by the<br>ASCII two-<br>character prefix:<br>CN      | U/M   | -5 to 5<br><br><b>Note:</b> Integer values only.<br>Negative Contrast settings are lower contrast where the amount of data that is represented by medium film densities is increased.<br>Positive settings are higher contrast where the amount of data that is represented by high and low densities is increased. | Value set in the<br>Printer by the user                                                                 |
| Pivot Density<br>designated by the<br>ASCII two-<br>character prefix:<br>PD | U/M   | 0.0 to 2.4<br><br><b>Note:</b> Value must be specified in increments of 0.2.<br>Densities above and below the pivot density will be adjusted up and down by an amount which is a function of the difference between the code value and the pivot density code value.                                                | Value set in the<br>Printer by the user                                                                 |



“LUT=0,3\ TM%PRNTDAT%%TIM%%FOF%”

The Perception LUT TFT set is 0 (default) and the Contrast Setting is 3.

The following text macros will be printed on the bottom of the page:

Date of Printing, Time of Printing, and Film of Film count.

“TM%PRNTDAT%%TIM%%FOF%”

The following text macros will be printed at the bottom of the page:

Date of Printing, Time of Printing, and Film of Film count.

"PD2.0\CN4\CS333"

This is **invalid** because the attributes are out of order, curve shape must precede pivot density and contrast, and contrast must precede pivot density. It should be "CS333\CN4\PD2.0".

"CS333\PD1.2\LUT=0,3"

This is **invalid** because Curve Shape and Pivot Density cannot be mixed with Perception LUT. In this case, the Perception LUT setting will be used