



DICOM Conformance Statement

**for ES9410 DICOM
(DICOM Embedded Printer)**

DICOM 3.0 Conformance Statement

Summary:

This document is the DICOM Conformance Statement of the Print Service Class Provider (SCP) software installed on OKI ES9410 DICOM printers. This Oki Data Corporation product: OKI ES9410 DICOM implements the necessary DICOM services to facilitate the Print (SCP) Imaging Management in the healthcare departments, managing Print imaging over a network on LED Imaging Printer Systems. It enables the capabilities to capture images at any networked DICOM modality and then print them anywhere they're needed in the medical facility.

Furthermore, before sending the images to be printed the OKI ES9410 DICOM will apply image processing, using presentation parameters and LUT to improve the image presentation quality and consistency. Moreover, it will manage the printing presentation format and the Printer queue and Configuration.

Table A.1-1 provides an overview of the network services supported by OKI ES9410 DICOM.

Table A.1-1 NETWORK SERVICES

| SOP Classes | User of Service (SCU) | Provider of Service (SCP) |
|---------------------------------|------------------------------|----------------------------------|
| Print Management | | |
| Grayscale Print Management Meta | No | Yes |
| Color Print Management Meta | No | Yes |
| Presentation LUT | No | Yes |
| Print Job | No | Yes |
| Verification | No | Yes |

TABLE OF CONTENTS

| | Page |
|---|------|
| 1 Introduction | 5 |
| 1.1 Scope and field of application | 5 |
| 1.2 Acronyms and abbreviations | 5 |
| 1.2.1 Terms and Definitions | 6 |
| 1.3 References | 9 |
| 1.4 Intended audience | 9 |
| 1.5 Note to the reader | 9 |
| 2 Implementation model | 10 |
| 2.1 Application data flow | 10 |
| 2.2 Functional Definition of Print Server (SCP) Application Entity | 11 |
| 2.3 Functional definitions of Application Entities | 11 |
| 2.3.1 Verification Service as SCP | 11 |
| 2.3.2 Print services as SCP | 11 |
| 2.4 Sequencing of real-world activities | 12 |
| 2.4.1 Print services as SCP | 12 |
| 3 Application Entity specifications | 13 |
| 3.1 Association establishment policies | 13 |
| 3.1.1 General | 13 |
| 3.1.2 Number of associations | 14 |
| 3.1.3 Asynchronous nature | 14 |
| 3.2 Association initiation by real-world activity | 14 |
| 3.3 Association acceptance policy | 14 |
| 3.3.1 Real-world activity: Print Management and Verification SCP | 14 |
| 3.3.1.1 Associated real-world activity | 14 |
| 3.3.1.2 Presentation | 15 |
| 3.3.1.3 SOP Specific Conformance | 16 |
| 3.3.1.3.1 SOP Specific Conformance for Storage SOP Class | 16 |
| 3.3.1.3.2 SOP Specific Conformance for Basic Film Session SOP Class | 16 |
| 3.3.1.3.3 SOP Specific Conformance for Basic Film Box SOP Class | 18 |
| 4 SOP Specific Conformance for Basic Grayscale Image Box SOP Class | 23 |
| 5 SOP Specific Conformance for Basic Color Image Box SOP Class | 24 |
| 6 Specific Conformance for Presentation LUT Box SOP class | 25 |
| 7 Communication Profiles | 27 |
| 7.1 Supported Communications Stacks | 27 |
| 7.1.1 Additional Protocols | 27 |

| | |
|---|----|
| 7.1.2 IPv4 and IPv6 Support | 27 |
| 7.2 TCP/IP Stack | 27 |
| 7.3 Physical Media Support | 27 |
| 8 Extensions/Specialization/Privatization | 27 |
| 9 Configuration | 28 |
| 9.1 AE Title/Presentation Address Mapping | 28 |
| 9.2 Parameters | 28 |

1 Introduction

1.1 Scope and field of application

This document describes OKI Print SCP (hereinafter referred to as "Print SCP") conformance to the DICOM 3.0 standard.

It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are the supported DICOM SOP Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes. It should be read in conjunction with the DICOM standard and its addenda.

This statement is conformant with the recommended format as described in PS 3.2 of the DICOM standard. Print SCP acts as a SCP for the following SOP Classes:

- Basic Grayscale Print Management Meta SOP Class
- Basic Color Print Management Meta SOP Class
- Verification SOP Class
- Print Job SOP Class
- Presentation LUT SOP Class
- Basic Film Session SOP Class
- Basic Film Box SOP Class
- Basic Grayscale Image Box SOP Class
- Basic Color Image Box SOP Class

1.2 Acronyms and abbreviations

The following acronyms and abbreviations are used in this document:

- ACR: American College of Radiology
- ANSI: American National Standards Institute
- DICOM: Digital Imaging and Communications in Medicine
- DIMSE: DICOM Message Service Element
- DIMSE-C: DICOM Message Service Element – Composite
- DIMSE-N: DICOM Message Service Element – Normalized
- NEMA: National Electrical Manufacturers Association
- PDU: Protocol Data Unit
- SCP: Service Class Provider
- SCU: Service Class User
- SOP: Service Object Pair
- TCP/IP: Transmission Control Protocol/Internet Protocol
- UID: Unique Identifier

1.2.1 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association – a network communication channel set up between Application Entities.

Attribute – a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media. (e.g., CDs)

Module – a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.3 References

[DICOM]

Digital Imaging and Communications in Medicine

DICOM standard:

NEMA PS 3.1 to 3.14 and Supplements

National Electrical Manufacturers Association (NEMA) – Publication Sales -
1300 N. 17th Street, Suite 1847

Rosslyn, Va. 22209, United States of America

1.4 Intended audience

This Conformance Statement is intended for:

Potential users

System integrators of medical equipment

Software designers implementing DICOM interfaces

1.5 Note to the reader

This document is written for the people that need to understand how OKI ES9410 DICOM will integrate into their healthcare facility.

This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product.

This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

Comparison of this Conformance Statement and the Conformance Statement of another device may show that the other device conforms to this Conformance Statement.

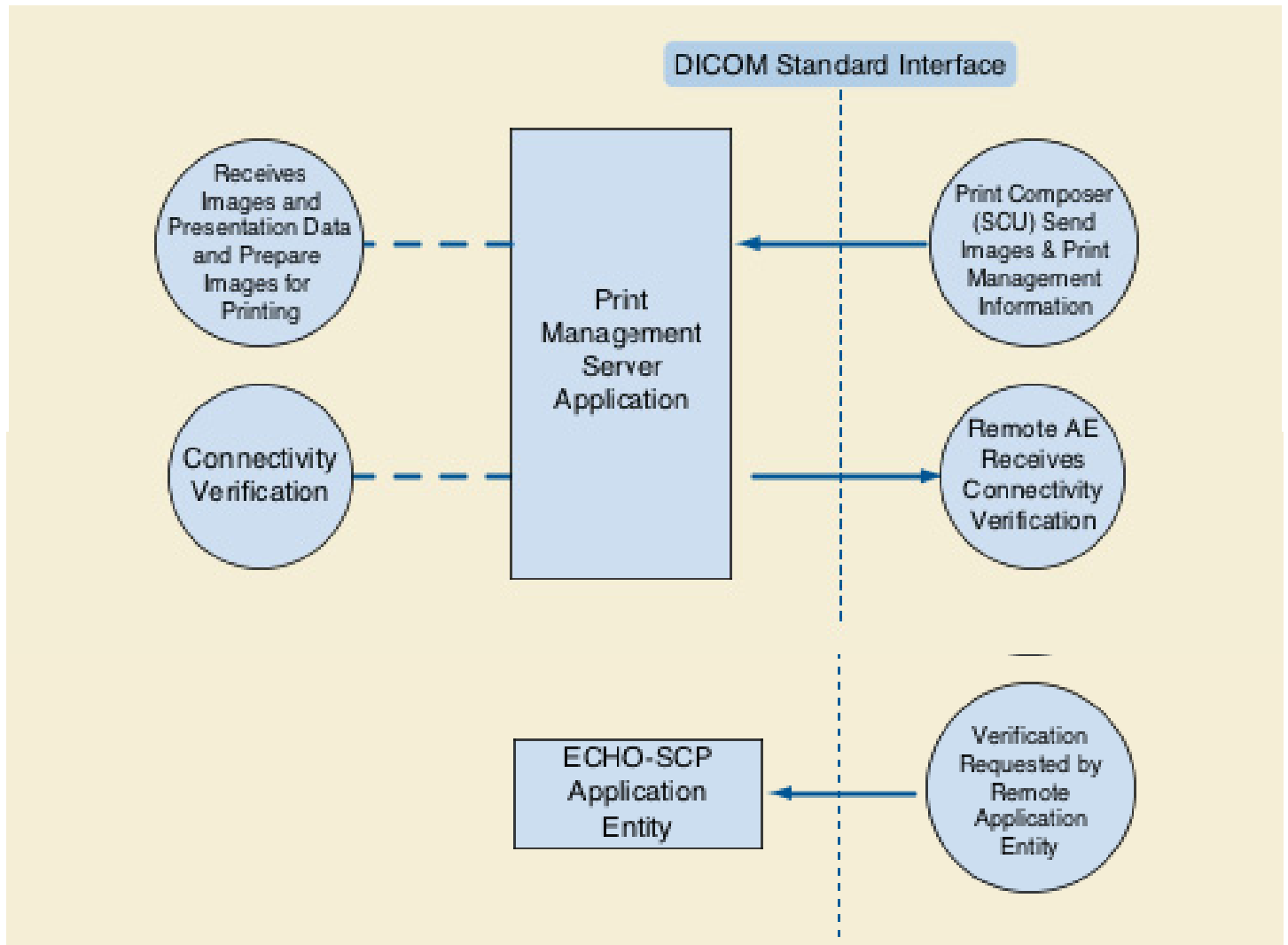
In that case, the other device may be interoperable with this product, but no guarantee is given.

DICOM only deals with communications; it is not a standard that specifies what is needed for certain applications to run on a device.

2 Implementation model

2.1 Application data flow

Print SCP is a DICOM printing solution that can receive images from DICOM modalities and render the images on paper by using Print SCU capabilities.



The Print Server is receiving the Images with the Presentation information, it Apply it on the images and creates a print-job within the print queue, containing one or more film pages composed from images selected by the client Print SCU. Furthermore, it also manages the Printer Status and Configuration.

2.2 Functional Definition of Print Server (SCP) Application Entity

The Print Server System acquires the images with the demographics and presentation information from the connected Print Composer (SCU) that is Grouped with a Workstation or an Archive device. Studies are temporarily stored on memory. The images are then processed and formatted and finally queued as a print job on the Printer queue. If the Printer is not operating normally (e.g. film Magazine empty), then the printer will be set to an error state and can be restarted by the user via the control panel interface.

The Print Server Management includes:

- DICOM Association and Negotiation Management
- Image Buffering
- Image Processing (Windowing level, P-LUT, GSDF, etc.)
- Image Formatting (Film sheet format)
- Printing

Furthermore, the Print Server provides in addition a Service operation of checking the networking connectivity to it's Print SCU using the Verification SOP Class.

2.3 Functional definitions of Application Entities

2.3.1 Verification Service as SCP

Print SCP waits for another application to connect at the presentation address configured in the network settings.

When another application connects, Print SCP expects it to be a DICOM application. Print SCP will accept associations with Presentation Contexts for SOP Classes of the Verification Service Class.

2.3.2 Print services as SCP

Once started, Print SCP waits for association requests. For each accepted request, it processes on the association the received print commands compatible with the SOP Classes it supports.

Associations are released either on Print SCU request or when an error condition occurs that leads to an association abort.

2.4 Sequencing of real-world activities

2.4.1 Print services as SCP

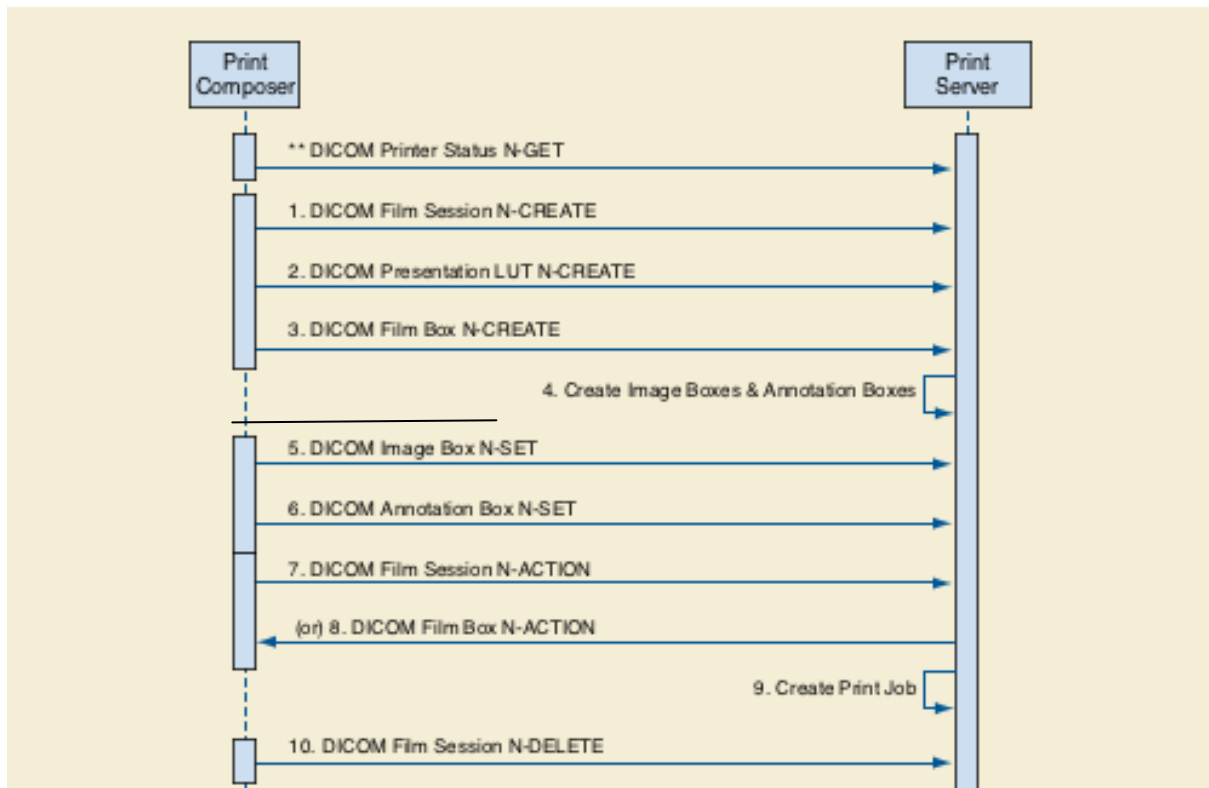


Figure 2.2.3-2. Print Server Management Sequence

The Print Server Management workflow activities in the sequence order as described in Figure 2.2.3-2 apply:

1. DICOM Film Session N-CREATE
2. DICOM Presentation LUT N-CREATE
3. DICOM Film Box N-CREATE
4. Create Image Boxes & Annotation Boxes
5. DICOM Image Box N-SET
6. DICOM Annotation Box N-SET
7. DICOM Film Session N-ACTION, A print job is created for each Film Session N-action.
8. DICOM Film Box N-ACTION, A print job is created for each Film Box N-action.
9. Create Print Job
10. DICOM Film Session N-DELETE.

3 Application Entity specifications

In its default configuration, Print SCP exists as a single Application Entity (AE) "OKI". You can add several Application Entity Titles (AET), define each of those and add rules for color adjustment.

As far as the association acceptance is concerned, Print SCP does not check any matching between its AET and the called AET of the incoming DICOM association.

Print SCP provides standard conformance to the following DICOM V3.0 SOP Classes as an SCP:

| SOP Class Name | UID |
|---|-------------------------|
| Verification SOP Class | 1.2.840.10008.1.1 |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.1.9 |
| Basic Color Print Management Meta SOP Class | 1.2.840.10008.5.1.1.18 |
| Printer SOP Class | 1.2.840.10008.5.1.1.16 |
| 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 |
| Basic Color Image Box SOP Class | 1.2.840.10008.5.1.1.4.1 |
| Presentation LUT SOP Class | 1.2.840.10008.5.1.1.23 |

3.1 Association establishment policies

3.1.1 General

Before any SOP Classes can be exchanged between the SCU AE and the PMS (SCP), an association stage takes place to negotiate and exchange the capabilities of the SCU and SCP. The Print Management SCU and SCP establish an association by using the Association Services of the DICOM Upper Layer. During association establishment, the DICOM Print Management AE negotiates with the supported SOP classes.

Only the SCU AE shall release an association. The released association may be aborted by the SCU or the SCP. The SCU AE attempts to initiate a new association for each print session. This means that when no operation is done on the association, the SCU should release the association.

A DICOM entity can only send DIMSE messages to instances that are created on the same association.

The Maximum PDU Length offered by Print SCP (SCP) at association establishment time can be configured by the user, and may range between the following minimum and maximum values:

Minimum value for Maximum PDU Length: 8192 bytes

Maximum value for Maximum PDU Length: 131072 bytes

3.1.2 Number of associations

In its standard configuration, The OKI ES9410 DICOM will accept Up to 5 simultaneous delivery Associations for Print-SCP. If an attempt is made to open more than 5 simultaneous Associations for Print-SCP, the Print Server System will reject the additional Associations (A-ASSOCIATE-RJ).

Number of Associations as a SCP for PRINT-SCP

| | |
|---|---|
| Maximum number of simultaneous Associations | 5 |
|---|---|

3.1.3 Asynchronous nature

The OKI ES9410 DICOM does not support asynchronous operations.

3.2 Association initiation by real-world activity

The OKI ES9410 DICOM never initiates an association, since it acts as a SCP from a DICOM protocol point of view.

3.3 Association acceptance policy

The OKI ES9410 DICOM accepts DICOM associations according to the DICOM Meta SOP Classes and SOP Classes it supports. Print SCP does not perform any check on the called AET at association acceptance time.

3.3.1 Real-world activity: Print Management and Verification SCP

3.3.1.1 Associated real-world activity

The application entity waits for incoming associations. No operator action is required to receive DICOM print jobs or verification requests.

3.3.1.2 Presentation

The OKI ES9410 DICOM accepts the following Presentation Contexts:

ACCEPTED PRESENTATION CONTEXTS FOR PRINT SERVER MANAGEMENT ACTIVITY

| Presentation Context Table | | | | | |
|---|-------------------------|------------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Grayscale Print Management Meta SOP | 1.2.840.10008.5.1.1.9 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Color Print Management Meta SOP | 1.2.840.10008.5.1.1.18 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Presentation LUT | 1.2.840.10008.5.1.1.23 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Printer | 1.2.840.10008.5.1.1.16 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Film Session SOP Class | 1.2.840.10008.5.1.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Film Box SOP Class | 1.2.840.10008.5.1.1.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Grayscale Image Box SOP Class | 1.2.840.10008.5.1.1.4 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Basic Color Image Box SOP Class | 1.2.840.10008.5.1.1.4.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

3.3.1.3 SOP Specific Conformance

3.3.1.3.1 SOP Specific Conformance for Printer SOP Class

The Printer SOP Class is used to monitor the status of the printer. The following DIMSE services are supported:

- N-GET

N-GET is used to retrieve an instance of the Printer SOP Class. The attributes of N-GET are shown in the following table:

| Tag | Name | Comment |
|-------------|--------------------------|---|
| (2110,0010) | Printer Status | Returns the Printer Status |
| (2110,0020) | Printer Status Info | Returns the Printer Status |
| (2110,0030) | Printer Name | Returns the name: OKI DM PRINTER |
| (0008,0070) | Manufacturer | Returns the manufacturer: Oki Data Corp |
| (0008,1090) | Manufacturer Model Name | Returns the model : ES9410 DICOM |
| (0018,1000) | Device Serial Number | Returns the printer serial number |
| (0018,1020) | Software Version(s) | Returns the software release |
| (0018,1200) | Date of Last Calibration | Returns the date of calibration |
| (0018,1201) | Time of Last Calibration | Returns the time of calibration |

3.3.1.4 SOP Specific Conformance for Basic Film Session SOP Class

The following DIMSE services are supported:

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

Film Session SOP Class Operations for N-CREATE

N-CREATE is sent by the SCU AE to create a Basic Film Session SOP instance when an association has been established. If N-CREATE fails, an error message will be returned by the SCP AE. N-CREATE causes the Basic Film Session to be created and its attributes initialized.

The Basic Film Session SOP instances shall be created before the Film Box SOP Instances are created. Print SCP provides the following support for the attributes contained in the N-CREATE DIMSE Service of the Basic Film Session SOP Class:

| Tag | Name | Value |
|--------------|--------------------|--|
| (2000, 0010) | Number of Copies | Any integer between 1 and 99 Default 1 |
| (2000, 0020) | Print Priority | Ignored, DEFAULT: MED |
| (2000, 0030) | Medium Type | Ignored, DEFAULT: PAPER. |
| (2000, 0040) | Film Destination | Ignored, DEFAULT: PROCESSOR |
| (2000, 0050) | Film Session Label | Ignored |
| (2000, 0060) | Memory Allocation | Ignored |
| (2100, 0160) | Owner ID | Ignored, DEFAULT: MSD |

The SCP will return one of the following status codes for FILM SESSION SOP CLASS N-CREATE RESPONSE:

| Code | Status | Comment |
|-------------|---------------|------------------------------------|
| 0x0000 | Success | Film session successfully created. |

Film Session SOP Class Operations for N-SET

N-SET is used to update an instance of the Basic Film Session SOP Class. The following attributes may be updated:

| Tag | Name |
|-------------|--------------------|
| (2000,0010) | Number of Copies |
| (2000,0020) | Print Priority |
| (2000,0030) | Medium Type |
| (2000,0040) | Film Destination |
| (2000,0050) | Film Session Label |
| (2000,0060) | Memory Allocation |
| (2100,0160) | Owner ID |

The SCP will return one of the following status codes for FILM SESSION SOP CLASS N-SET RESPONSE:

| Code | Status | Comment |
|-------------|---------------|---|
| 0x0000 | Success | Film session has been successfully updated. |

Film Session SOP Class Operations for N-ACTION

The receipt of the N-ACTION will result in submitting a print job to print all the films of the film session in the order that they were received. The Film Session N-ACTION arguments are defined in the DICOM Standard PS 3.4, table H.4-3.

The SCP will return one of the following status codes for Film Session SOP Class N-ACTION Response:

| Code | Status | Comment |
|-------------|---------------|---|
| 0x0000 | Success | Film session has been successfully accepted for printing. |

Film Session SOP Class Operations for N-DELETE

The Print Server Management behavior and specific status codes sent for the N-DELETE of a specific Film Session is described in the following table:

The SCP will return one of the following status codes for Film Session SOP Class N-DELETE Response:

| Code | Status | Comment |
|-------------|---------------|---|
| 0x0000 | Success | The SCP has completed the operation successfully. Film session has been successfully deleted. |

3.3.1.5 SOP Specific Conformance for Basic Film Box SOP Class

The following DIMSE services are supported:

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

Basic Film Box SOP Class Operations for N-CREATE

The OKI ES9410 DICOM provides the following support for the Film Box attributes sent by the N-CREATE DIMSE service

BASIC FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES

| Attribute | Tag | Valid Range | Default Value if not sent by SCU or invalid value received |
|-------------------------------------|-------------|---|---|
| Image Display Format | (2010,0010) | STANDARD\C,R | STANDARD\1,1 |
| Referenced Film Session Sequence | (2010,0500) | N/A | N/A |
| > Referenced SOP Class UID | (0008,1150) | SOP Class UID | Mandatory, no default |
| > Referenced SOP Instance UID | (0008,1155) | SOP Instance UID | Mandatory, no default |
| Referenced Image Box Sequence | (2010,0510) | N/A | N/A |
| > Referenced SOP Class UID | (0008,1150) | SOP Class UID | Mandatory, no default |
| > Referenced SOP Instance UID | (0008,1155) | SOP Instance UID | Mandatory, no default |
| Film Orientation | (2010,0040) | PORTRAIT LANDSCAPE | PORTRAIT |
| Film Size Id see Note 1 | (2010,0050) | A4 8.5INX 11IN A3 11INX17IN 13INX18IN 8.5INX35IN 8.5INX47IN 12INX35IN 12INX47IN 13INX35IN 13INX47IN | A4 |
| Magnification Type | (2010,0060) | REPLICATE BILINEAR CUBIC NONE | BILINEAR |
| Max Density | (2010,0130) | 0 - 100% | 100% |
| Smoothing Type See note 2 | (2010,0080) | NORMAL SHARP | Configurable |
| Border Density See note 3 | (2010,0100) | WHITE BLACK | WHITE |
| Empty Image Density See note 4 | (2010,0110) | WHITE BLACK | WHITE |
| Trim | (2010,0140) | YES NO | NO |
| Reference Presentation LUT Sequence | (2050,0500) | N/A | N/A |
| >Referenced SOP Class UID | (0008,1150) | SOP Class UID | Mandatory if sequence is present, no default |
| >Referenced SOP Instance UID | (0008,1155) | SOP Instance UID | Mandatory if sequence is present, no default |
| Illumination | (2010,015E) | Any valid value in the unit of cd/m ² | 2000, Mandatory if Presentation LUT is supported |
| Reflective Ambient Light | (2010,0160) | Any valid value in the unit of cd/m ² | 10, Mandatory if Presentation LUT is supported |

- Note 1: 8INX10IN input request size are translated to A4/Letter
 10INX14IN input request size are translated to A3/Tabloid
 11INX14IN input request size are translated to A3/Tabloid
 14INX17IN input request size are translated to A3/Tabloid
- Note 2: Smoothing Type - this attribute allows the SCU to specify the various smoothing effects provided by the interpolation algorithm in the OKI ES9410 DICOM.
- Note 3: Border Density - allows the density of the areas surrounding and between images on the film to be either Black or white.
- Note 4: Empty Image Density - allows the density of the areas of empty images on the film to be either Black or white.

SCP Pixel Matrix for a Pixel Size of 0.117 mm (216dpi)

With Text as Header

| Film Size | Rows | Columns |
|------------------------|-------------|----------------|
| A4 (Portrait) | 1707 | 2379 |
| A4 (Landscape) | 2379 | 1707 |
| Letter (Portrait) | 1758 | 2268 |
| Letter (Landscape) | 2268 | 1758 |
| A3 (Portrait) | 2448 | 3462 |
| A3 (Landscape) | 3462 | 2448 |
| Tabloid (Portrait) | 2298 | 3564 |
| Tabloid (Landscape) | 3564 | 2298 |
| A3 NOBI (Portrait) | 2712 | 3744 |
| A3 NOBI (Landscape) | 3744 | 2712 |
| 215 x 900 (Portrait) | 1758 | 7542 |
| 215 x 900 (Landscape) | 7542 | 1758 |
| 215 x 1200 (Portrait) | 1758 | 10095 |
| 215 x 1200 (Landscape) | 10095 | 1758 |
| 297 x 900 (Portrait) | 2448 | 7542 |
| 297 x 900 (Landscape) | 7542 | 2448 |
| 297 x 1200 (Portrait) | 2448 | 10095 |
| 297 x 1200 (Landscape) | 10095 | 2448 |
| 328 x 900 (Portrait) | 2712 | 7542 |
| 328 x 900 (Landscape) | 7542 | 2712 |
| 328 x 1200 (Portrait) | 2712 | 10095 |
| 328 x 1200 (Landscape) | 10095 | 2712 |

With Logo as Header

| Film Size | Rows | Columns |
|---------------------|-------------|----------------|
| A4 (Portrait) | 1707 | 2310 |
| A4 (Landscape) | 2310 | 1707 |
| Letter (Portrait) | 1758 | 2160 |
| Letter (Landscape) | 2160 | 1758 |
| A3 (Portrait) | 2448 | 3354 |
| A3 (Landscape) | 3354 | 2448 |
| Tabloid (Portrait) | 2298 | 3456 |
| Tabloid (Landscape) | 3456 | 2298 |

| | | |
|------------------------|------|------|
| A3 NOBI (Portrait) | 2712 | 3636 |
| A3 NOBI (Landscape) | 3636 | 2712 |
| 215 x 900 (Portrait) | 1758 | 7434 |
| 215 x 900 (Landscape) | 7434 | 1758 |
| 215 x 1200 (Portrait) | 1758 | 9987 |
| 215 x 1200 (Landscape) | 9987 | 1758 |
| 297 x 900 (Portrait) | 2448 | 7434 |
| 297 x 900 (Landscape) | 7434 | 2448 |
| 297 x 1200 (Portrait) | 2448 | 9987 |
| 297 x 1200 (Landscape) | 9987 | 2448 |
| 328 x 900 (Portrait) | 2712 | 7434 |
| 328 x 900 (Landscape) | 7434 | 2712 |
| 328 x 1200 (Portrait) | 2712 | 9987 |
| 328 x 1200 (Landscape) | 9987 | 2712 |

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-CREATE RESPONSE:

| Code | Status | Comment |
|--------|---------|------------------------------------|
| 0x0000 | Success | Film Box was successfully created. |

Basic Film Box SOP Class Operations for N-SET

N-SET DIMSE service allows to update the following attributes of an existing Basic Film Box SOP Instance:

| Tag | Name |
|-------------|--------------------------------------|
| (2010,0010) | Image Display Format |
| (2010,0040) | Film Orientation |
| (2010,0050) | Film Size ID |
| (2010,0060) | Magnification Type |
| (2010,0080) | Smoothing Type |
| (2010,0100) | Border Density |
| (2010,0110) | Empty Image Density |
| (2010,0120) | Minimum Density |
| (2010,0130) | Maximum Density |
| (2010,0140) | Trim |
| (2010,0150) | Configuration Information |
| (2050,0500) | Referenced Presentation LUT Sequence |

| | |
|-------------|------------------------------|
| (0008,1150) | >Referenced SOP Class UID |
| (0008,1155) | >Referenced SOP Instance UID |

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-SET RESPONSE:

| Code | Status | Comment |
|--------|---------|------------------------------------|
| 0x0000 | Success | Film Box was successfully created. |

Basic Film Box SOP Class Operations for N-Action

The OKI ES9410 DICOM provides the support for submitting the print job for printing the specific Film Box. The Film BOX N-ACTION arguments are defined in the DICOM Standard PS 3.4, table H.4-8.

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-ACTION Response:

| Code | Status | Comment |
|--------|---------|------------------------------------|
| 0x0000 | Success | Film Box was successfully printed. |

Basic Film Box SOP Class Operations for N-DELETE

The OKI ES9410 DICOM provides the support for deleting the last created Film Box.

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-DELETE Response:

| Code | Status | Comment |
|--------|---------|------------------------------------|
| 0x0000 | Success | Film Box was successfully deleted. |

4 SOP Specific Conformance for Basic Grayscale Image Box SOP Class

The following DIMSE services are supported:

- N-SET
- True Size Printing

True size printing is controlled by the DICOM tag (2020,0030) requested image size. The software calculates the size (width in MM) of the image, based on the pixel spacing and sends that value to the printer.

IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

The OKI ES9410 DICOM provides the following support for the attributes contained in the N-SET DIMSE Service of the Basic Grayscale Image Box SOP Class:

| Tag | Name | Value |
|-------------|--------------------------------|---|
| (2020,0010) | Image Position | |
| (2020,0020) | Polarity | NORMAL or REVERSE |
| (2010,0060) | Magnification Type | Ignored. Always BILINEAR |
| (2010,0080) | Smoothing Type | NORMAL or SHARP |
| (2020,0030) | Requested image size | The width in mm. It is calculated based on pixel spacing. |
| (2020,0110) | Basic Grayscale Image Sequence | |
| (0028,0002) | >Samples Per Pixel | 1 |
| (0028,0004) | >Photometric Interpretation | MONOCHROME1 MONOCHROME2 |
| (0028,0010) | >Rows | |
| (0028,0011) | >Columns | |
| (0028,0100) | >Bits Allocated | 8 |
| (0028,0101) | >Bits Stored | 8 |
| (0028,0102) | >High Bit | 7 |
| (0028,0103) | >Pixel Representation | |
| (0028,0034) | >Pixel Aspect Ratio | |
| (7FE0,0010) | >Pixel Data Mandatory | |

The SCP will return one of the following status codes for IMAGE BOX SOP CLASS N-SET RESPONSE:

| Code | Status | Comment |
|--------|---------|---------------------------------|
| 0x0000 | Success | Image Box was successfully set. |

5 SOP Specific Conformance for Basic Color Image Box SOP Class

The following DIMSE services are supported:

- N-SET

IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

The OKI ES9410 DICOM provides the following support for the attributes contained in the N-SET DIMSE Service of the Basic Color Image Box SOP Class:

| Tag | Name | Value |
|-------------|-----------------------------|---|
| (2020,0010) | Image Position | |
| (2020,0020) | Polarity | NORMAL or REVERSE |
| (2010,0060) | Magnification Type | Ignored. Always BILINEAR |
| (2010,0080) | Smoothing Type | NORMAL |
| (2020,0030) | Requested image size | The width in mm. It is calculated based on pixel spacing. |
| (2020,0110) | Basic Color Image Sequence | |
| (0028,0002) | >Samples Per Pixel | 1 |
| (0028,0004) | >Photometric Interpretation | RGB |
| (0028,0006) | >Planar Configuration | 0 or 1 |
| (0028,0010) | >Rows | |
| (0028,0011) | >Columns | |
| (0028,0100) | >Bits Allocated | 8 |
| (0028,0101) | >Bits Stored | 8 |
| (0028,0102) | >High Bit | 7 |
| (0028,0103) | >Pixel Representation | |
| (0028,0034) | >Pixel Aspect Ratio | |
| (7FE0,0010) | >Pixel Data Mandatory | |

The SCP will return one of the following status codes for IMAGE BOX SOP CLASS N-SET RESPONSE:

| Code | Status | Comment |
|--------|---------|---------------------------------|
| 0x0000 | Success | Image Box was successfully set. |

6 Specific Conformance for Presentation LUT Box SOP class

The OKI ES9410 DICOM supports the Presentation LUT SOP class as SCP. Print SCU may negotiate this support and create a Presentation LUT instance prior to the creation of Film Boxes or Image Boxes. Multiple Presentation LUT instances are supported in an association, but only one instance will be supported for each image.

The SCU shall send either Presentation LUT Sequence or the Presentation LUT Shape. These values are mutually exclusive and the action will result in an error if neither or both are present. The presence of the Presentation LUT instance overrides any data set in the Configuration Information attribute (2010,0150) of the Film Box or Image Box.

The Print Server Management System provides support for the following DIMSE Services:

- N-CREATE
- N-DELETE

Presentation LUT Box SOP class operation for N-CREATE

The Print Server Management System supports the following attributes of the N-CREATE DIMSE Service of the Presentation LUT SOP Class:

PRESENTATION LUT SOP CLASS N-CREATE REQUEST ATTRIBUTES

| Attribute & Usage | Tag | Supported Values | Default Values if not sent by SCU or invalid value received |
|---------------------------|-------------|--|---|
| Presentation LUT Sequence | (2050,0010) | | None. |
| >LUT Descriptor | (0028,3002) | The first value is the number of entries in the lookup table. The second value represents the first mapped value of the LUT. The third value shall be 10-16 (which represents the bit depth of each LUT entries. | First value should be the number of LUT entries. Second value should be 0. The third value default is 12. |
| >LUT Explanation | (0028,3003) | | None. |
| >LUT Data | (0028,3006) | | None. |
| Presentation LUT Shape | (2050,0020) | Enumerated values: IDENTITY, LIN OD, INVERSE | None. |

The Print Server Management behavior and specific status codes sent for the N-CREATE of a specific Presentation LUT is described in the following table:

PRESENTATION LUT SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR

| Service Status | Further Meaning | Error Code | Behavior |
|-----------------------|------------------------|-------------------|--|
| Success | Success | 0000 | The SCP has completed successfully the creation of the Presentation LUT. |

Presentation LUT Box SOP class operation for n-DELETE

When a N-DELETE DIMSE service is requested with a specific Presentation LUT SOP instance, the Print Server Management System will not delete the specified Presentation LUT SOP instance as long as there are outstanding references to it. Otherwise, it deletes the specified Presentation LUT SOP instance.

Consistent Presentation of Grayscale Images

The OKI ES9410 DICOM supports the DICOM standard (PS 3-14) Grayscale Standard Display Function (GSDF) for Consistent Presentation of Displayed and Printed Images. The Image Consistency is achieved through the support of the Presentation LUT (transforming the image pixels value in to the Standard Presentation P-values) and then Transforming the Image pixel values from the standard Presentation (P-value) space to the Optical Density space. Calibrating the Imager Printer Device to adjust the Printer Imager characteristic curve to fit the GSDF curve. The OKI ES9410 DICOM Service Manual describes in details the Imager Printer calibration to the DICOM GSDF curve.

7 Communication Profiles

7.1 Supported Communications Stacks

The OKI ES9410 DICOM supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

SUPPORTED PHYSICAL NETWORK INTERFACES

| |
|--------------------|
| Ethernet 1000baseT |
| Ethernet 100baseT |
| Ethernet 10baseT |

7.1.1 Additional Protocols

DHCP can be used to obtain TCP/IP network configuration information (e.g. own TCP/IP address, net-mask, default gateway, DNS server, etc.). Support for DHCP can be configured via the Printer Control Panel. If DHCP is not in use, TCP/IP network configuration information can be manually configured via the Printer Control Panel.

DNS can be used for address resolution. If DHCP is not in use, the identity of a DNS server can be configured via the Printer Control Panel. If a DNS server is not in use, local mapping between hostname and TCP/IP address can be manually configured via the Printer Control Panel.

7.1.2 IPv4 and IPv6 Support

This product supports IPv4.

7.2 TCP/IP Stack

Print SCP inherits its TCP/IP stack from the OKI printer system upon which it is executed.

7.3 Physical Media Support

Print SCP is irrelevant of the physical medium over which TCP/IP executes; it inherits this from the system upon which it is executed.

8 Extensions/Specialization/Privatization

No extensions defined.

9 Configuration

9.1 AE Title/Presentation Address Mapping

Print SCP configuration is included in the application user interface through the setup dialog.

The Field Service Engineer can configure the IP Address via the Printer Control Panel. A Default AE Titles "OKI" are provided. The other AE Titles must be configured during installation. The local AET used by each individual application can be configured independently of the AET used by other local applications. If so configured, all local AE's are capable of using the same AET or different AET.

AE TITLE CONFIGURATION TABLE

| Application Entity | Default AE Title | Default TCP/IP Port |
|---------------------------|-------------------------|----------------------------|
| PRINT-SCP | OKI | 11112 |

9.2 Parameters

A large number of parameters related to Print Management, Communications and general operation can be configured using the user interface.

The following table shows those configuration parameters relevant to DICOM communication. See the OKI ES9410 DICOM Configuration Service Manual for details on general configuration capabilities.

CONFIGURATION PARAMETERS TABLE

| Parameter | Configurable (Yes/No) | Default Value |
|---|------------------------------|---------------------------|
| General Parameters | | |
| Max PDU Receive Size | Yes | 128 KB |
| Max PDU Send Size (If the receiver supports a smaller Max PDU Receive Size then the Max PDU Send Size will be reduced accordingly for the duration of the Association. Max PDU Receive Size information is exchanged during DICOM Association Negotiation in the Maximum Length Sub-Item of the A-ASSOCIATION-RQ and A-ASSOCIATE-AC) | Yes | 128 KB |
| Time-out waiting for an acceptance or rejection response to an Association Request (Application level Timeout). | No | 150 s |
| Maximum number of simultaneous Associations | No | 5 |
| Supported Transfer Syntaxes | No | Implicit VR Little Endian |

| Parameter | Configurable (Yes/No) | Default Value |
|---|----------------------------------|---|
| Print Server Management | | |
| Default Print parameters: Contrast, Border Density, Smoothing factor, Polarity, Orientation, etc. | Yes | Configurable |
| Number of times a failed print-job may be retried | No | NA |
| Delay between retrying failed print-jobs | No | NA |
| Printer Bit-depth Configurable: 8 , 10, 12 or 16 | Yes | 8 |
| Custom Format | No | NA |
| Media Type: Reflective (Paper) | Yes | Paper |
| Media size Configurable: A4, A3, Letter, Tabloid, 13X18IN, 8_5X35IN, 8_5X47IN, 12X35IN, 12X47IN, 13X35IN and 13X47IN | Yes | A4 |
| Maximum number of printable pixel matrix per supported Media size | No | See page 20. |
| Maximum Pixel size | No | 0.117 mm (216dpi) |
| Maximum number of collated films in a film session | Yes | 10 |
| Support N-EVENT-REPORT (On/Off for either Printer, Print Job or both). | No | NA |
| Handling of print jobs when requested Media Type and/or Film Size are not currently installed. The options are: 1. Queue the print job until the film matching the requested Media Type and/or Film Size is loaded. 2. Print on the film currently loaded in the printer. | Yes | Queue the print job until the paper matching the requested Media Size is loaded |