DICOM CONFORMANCE STATEMENT FOR THE LODOX STATSCAN SYSTEM

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1. SCOPE

1.1 Introduction

This DICOM Conformance Statement specifies the behavior and functionality of software contained within the Lodox Statscan full-body digital X-ray scanner. It includes both the Statscan System operating software and the Diagnostic Viewing System (DVS) Software

1.2 Purpose

This DICOM Conformance Statement documents the conformance of the Lodox Statscan software with the Digital Imaging and Communications in Medicine (DICOM) standard. This document is essential in order to evaluate whether or not another DICOM compliant device can communicate with this software. This statement conforms to the recommended format as described in PS 3.2 of the DICOM standard.

1.3 Applicability

Lodox Statscan System Software.

2. APPLICABLE DOCUMENTS AND REFERENCES

2.1 Applicable Documents

2.2 References

DICOM (Digital Imaging and Communications in Medicine), NEMA, PS3.1 – 16, 2001.

3. ACRONYMS, ABBREVIATIONS AND DEFINITIONS

3.1 Acronyms and Abbreviations

ASCII	American Standard Code for Information Interchange
AE	Application Entity
ANSI	American National Standards Institute
DICOM	Digital Imaging and Communications in Medicine
DVS	Diagnostic Viewing System
DX	Digital X-ray
IE	Information Entity
IOD	Information Object Definition
ISO	International Standards Organization
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
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
VM	Value Multiplicity
VR	Value Representation

4. IMPLEMENTATION MODEL

The Statscan system is able to query a Modality Worklist (MWL) server in order to obtain patient demographic information from the MWL server. That is, the Statscan system acts as a DICOM Modality Worklist SCU.

The DVS software can send images to a DICOM-compatible storage system, as well as print images to a DICOM-compatible printer/laser camera. That is, the DVS software acts as a DICOM Storage SCU and a DICOM Print SCU. It also can act as a DICOM Verification SCU. A single application entity is shared for the storage and printing SCUs.

4.1 Application Data Flow Diagrams

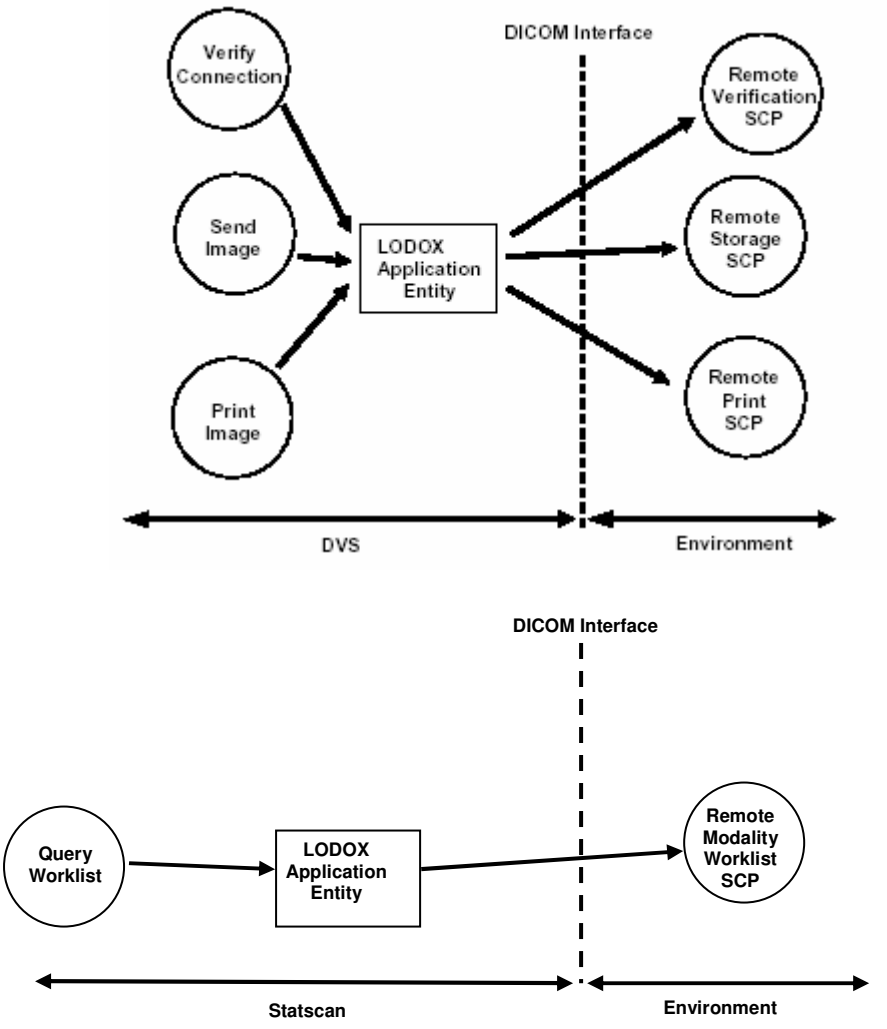

Figure 1: Implementation Models

5. FUNCTIONAL DEFINITION OF AES

5.1 Modality Worklist SCU

The Modality Worklist SCU Application Entity is started when an operator uses the Worklist Query application to search for Patient Demographic information on a remote server.

The query request (C-Find) is transmitted over a single association. The results of the query (if any) are returned to the SCU using the same association. When the SCP returns a status of Complete, the association is released and the Modality Worklist SCU terminates. If the transmission fails for any reason, the association is aborted and the Modality Worklist SCU terminates.

5.1.1 Modality Worklist SCU AE Specification

This application entity provides conformance to the following DICOM SOP classes as SCU:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

5.1.2 Association Establishment

5.1.2.1 General

The PDU Length is configurable by the System Administrator. If no value is specified, the PDU Length defaults to 16384 bytes.

SOP Class extended negotiation is not supported.

5.1.2.2 Number of Associations

The Modality Worklist SCU will only propose a single Association at a time.

5.1.2.3 Asynchronous Nature

Asynchronous operation is not supported by this SCU.

5.1.2.4 Implementation Identifying Information

The following implementation information is valid:

Implementation Version Name	OFFIS_DCMTK_352
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.2
DICOM Application Context Name	1.2.840.10008.3.1.1.1

5.1.3 Association Initiation Policy

The application entity initiates an association with the selected remote Modality Worklist SCP. The calling application entity name is configurable by the system administrator. If the calling application entity name has not been configured it is set to LODOX. The called application entity name must be configured together with the presentation address to be used by using the Remote Application Entity configuration tool.

5.1.3.1 Associated Real-World Activity

The user starts the Worklist Query application, enters fields to search with, chooses a Remote AE to establish the Association with and clicks “Query”.

5.1.3.2 Proposed Presentation Contexts

For each of the supported SOP classes, the software proposes as SCU a single presentation context containing the following transfer syntaxes, any of which is acceptable:

Transfer Syntax	UID	Role	Extended Negotiation
Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

5.1.3.3 SOP Specific Conformance for Modality Worklist Management

In the Worklist Query application, the following fields are editable:

- Scheduled Station AE Title.
- Procedure Start Date – using the Date Picker controls.
- Modality – may be CR, DX or zero-length.
- Performing Physician – mapped to Scheduled Performing Physician’s Name (0040,0006).
- Patient Last Name – mapped to Last Name Component of Patient Name (0010,0010).
- Patient First Name – mapped to First Name Component of Patient Name (0010,0010).
- MRN / Patient ID – mapped to Patient ID (0010,0020). If this field is present then the Patient Name value will be zero-length.
- Accession Number – mapped to Accession Number (0008,0050). If this field is present then the Patient Name value will be zero length.

The following attributes are set as described for this SOP class:

Attribute Name	Tag	Match
Scheduled Station AE Title	(0040,0001)	Single value or zero-length
Scheduled Procedure Start Date	(0040,0002)	Single value, range match or zero-length
Scheduled Procedure Start Time	(0040,0003)	Zero-length
Modality	(0008,0060)	Single value or zero-length
Scheduled Performing Physician’s Name	(0040,0006)	Single value or zero-length

Scheduled Procedure Step Description	(0040,0007)	Zero-length
Scheduled Station Name	(0040,0010)	Zero-length
Scheduled Procedure Step Location	(0040,0011)	Zero-length
Pre Medication	(0040,0012)	Zero-Length
Scheduled Procedure Step ID	(0040,0009)	Zero-length
Requested Contrast Agent	(0032,1070)	Zero-length
Scheduled Procedure Step Status	(0040,0020)	Zero-length
Comments on the Sch. Proc. Step	(0040,0400)	Zero-length
Requested Procedure ID	(0040,1001)	Zero-length
Requested Procedure Description	(0032,1060)	Zero-length
Study Instance UID	(0020,000D)	Zero-length
Requested Procedure Priority	(0040,1003)	Zero-length
Patient Transport Arrangements	(0040,1004)	Zero-length
Accession Number	(0008.0050)	Single value or zero-length
Requesting Physician	(0032,1032)	Zero-length
Placer Order Number	(0040,2016)	Zero-length
Filler Order Number	(0040,2017)	Zero-length
Imaging Service Request Reason	(0040,2001)	Zero-length
Patient Name	(0010,0010)	Single value or zero-length
Patient ID	(0010,0020)	Single value or zero length
Issuer of Patient ID	(0010,0021)	Zero-length
Patient's Sex	(0010,0040)	Zero-length
Patient's Birth Date	(0010,0030)	Zero-length
Patient's Birth Time	(0010,0032)	Zero-length
Patient's Weight	(0010,1030)	Zero-length
Patient's Size	(0010,1020)	Zero-length
Confidentiality Constraint	(0040,3001)	Zero-length
Medical Alerts	(0010,2000)	Zero-length
Contrast Allergies	(0010,2110)	Zero-length
Pregnancy Status	(0010,21C0)	Zero-length
Special Needs	(0038,0050)	Zero-length
Patient State	(0038,0500)	Zero-length
Admission ID	(0038,0010)	Zero-length
Issuer of Admission ID	(0038,0011)	Zero-length
Visit Status ID	(0038,0008)	Zero-length
Current Patient Location	(0038,0300)	Zero-length
Referring Physician's Name	(0008,0090)	Zero-length

5.1.4 Association Acceptance Policy

Not applicable, as the Statscan cannot accept incoming Associations.

5.2 Store SCU

The Store SCU Application Entity is started when a user requests transmission of an image in the DVS database to a remote location.

A single image is transmitted over a single association. When the transmission of the image is complete, the association is released and the Store SCU terminates. If the transmission fails for any reason, the association is aborted and the Store SCU terminates.

5.2.1 Store SCU AE Specification

This application entity provides conformance to the following DICOM SOP classes as SCU:

SOP Class Name	SOP Class UID
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1

5.2.2 Association Establishment

5.2.2.1 General

The PDU Length is configurable by the System Administrator. If no value is specified, the PDU Length defaults to 16384 bytes.

SOP Class extended negotiation is not supported.

Although both the Digital X-ray Image Storage For Presentation and Computed Radiography Image Storage SOP classes are supported, the Store SCU will only use the Computed Radiography Image Storage SOP class if the SCP does not support the Digital X-ray Image Storage For Presentation SOP class. That is, the default behavior is for the DVS to act as SCU for the Digital X-ray Image Storage For Presentation SOP class. The Computed Radiography Image Storage SOP class should be considered as a “fallback” SOP class only.

5.2.2.2 Number of Associations

The Store SCU will only propose a single Association at a time.

5.2.2.3 Asynchronous Nature

Asynchronous operation is not supported by this SCU.

5.2.2.4 Implementation Identifying Information

The following implementation information is valid:

Implementation Version Name	OFFIS_DCMTK_352
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.2

DICOM Application Context Name 1.2.840.10008.3.1.1.1

5.2.3 Association Initiation Policy

The application entity initiates an association with the selected remote Storage SCP. The calling application entity name is set to LODOX. The called application entity name must be configured together with the presentation address to be used by using the Remote Application Entity configuration tool.

5.2.3.1 Associated Real-World Activity

The user selects the “Store” Option from the DICOM sub-menu, chooses a Remote AE to establish the Association with, and clicks “OK”.

5.2.3.2 Proposed Presentation Contexts

For each of the supported SOP classes, the software proposes as SCU a single presentation context containing the following transfer syntaxes, any of which is acceptable:

Transfer Syntax	UID	Role	Extended Negotiation
Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

5.2.3.3 SOP Specific Conformance for DX and CR Image Storage Class

The following attributes of the Image Pixel Module are set as described:

Attribute Name	Tag	Type	VR	VM	Comment
Samples Per Pixel	(0028,0002)	M/M	US	1	Value is 1
Photometric Interpretation	(0028,0004)	M/M	CS	1	Value is MONOCHROME2
Pixel Aspect Ratio	(0028,0034)	MC/M			Sent if pixel aspect ratio is not 1\1
Bits Allocated	(0028,0100)	M/M	US	1	Value is 16
Bits Stored	(0028,0101)	M/M	US	1	Value is 14
High Bit	(0028,0102)	M/M	US	1	Value is 13
Pixel Representation	(0028,0103)	M/M	US	1	Value is 0

5.2.4 Association Acceptance Policy

Not applicable, as the DVS software cannot accept incoming Associations. The DVS software as Storage SCP is not implemented.

5.3 Print SCU

The Print SCU Application Entity is started when a user requests printing of the current image to a remote DICOM printer.

The Print SCU prints a single Film Box as part of a print job over a single association. When the printing of the image is complete, the association is released and the Print SCU terminates. If the transmission to the printer fails for any reason, the association is aborted and the Print SCU terminates.

5.3.1 Print SCU AE Specification

This application entity provides conformance to the following DICOM SOP classes as SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9

This application entity does not provide conformance to any SOP classes as SCP.

5.3.2 Association Establishment

5.3.2.1 General

The PDU Length is configurable by the System Administrator. If no value is specified, the PDU Length defaults to 16384 bytes.

SOP Class extended negotiation is not supported

5.3.2.2 Number of Associations

The Print SCU will only propose a single Association at a time.

5.3.2.3 Asynchronous Nature

Asynchronous operation is not supported by this SCU.

5.3.2.4 Implementation Identification Information

The following implementation information is valid:

Implementation Version Name	OFFIS_DCMTK_352
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.2
DICOM Application Context Name	1.2.840.10008.3.1.1.1

5.3.3 Association Initiation Policy

The application entity initiates an association with the selected remote Print SCP. The calling application entity name is set to LODOX. The called application entity name

must be configured together with the presentation address to be used by using the Remote Application Entity configuration tool.

5.3.3.1 Associated Real-World Activity

The user selects the “Print” Option from the DICOM sub-menu, chooses a Remote AE to establish the Association with, and clicks “OK”.

5.3.3.2 Proposed Presentation Contexts

For each of the supported SOP classes, the software proposes as SCU a single presentation context containing the following transfer syntaxes, any of which is acceptable:

Transfer Syntax	UID	Role	Extended Negotiation
Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

5.3.3.3 SOP Specific Conformance for Printer SOP Class

Immediately after successful association negotiation, the Print SCU issues an N-GET-RQ message in order to retrieve the contents of the well-known Printer SOP Instance. The attribute identifier list element of the message remains empty, which means that the Print SCP is requested to transmit the contents of all attributes of the well-known Printer SOP Instance. If this request fails, the connection with the printer is released. Following retrieval of the well-known Printer SOP Instance, the association is released.

5.3.3.4 SOP Specific Conformance for Basic Film Session SOP Class

After retrieval of the well-known Printer SOP instance, a new association is established and, if this is successful, the Print SCU creates a Basic Film Session by issuing an N-CREATE-RQ message. The following elements are sent as part of the N-CREATE DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM	Comment
Number of Copies	(2000,0010)	U/M	IS	1	Default is 1
Print Priority	(2000,0020)	U/M	CS	1	Default is HIGH
Medium Type	(2000,0030)	U/M	CS	1	Default is CLEAR FILM
Film Destination	(2000,0040)	U/M	CS	1	Default is MAGAZINE
Film Session Label	(2000,0050)	U/U	LO	1	As specified by user

If creation of the Basic Film Session fails, Print SCU releases the association with the printer. After a successful completion of the print job, Print SCU uses an N-DELETE DIMSE Service Element to delete the Basic Film Session SOP instance before releasing the association. Other requests are never sent. In particular, Print SCU never sends an N-ACTION message on Basic Film Session level.

5.3.3.5 SOP Specific Conformance for Basic Film Box Class

After successful creation of the Basic Film Session SOP instance, the Print SCU creates a Basic Film Box. The following elements are sent as part of the N-CREATE DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM	Comment
Image Display Format	(2010,0010)	M/M	ST	1	Fixed at 'STANDARD\1,1'
Referenced Film Session Sequence	(2010,0500)	M/M	SQ	1	
> Referenced SOP Class UID	(0008,1150)	M/M	UI	1	
> Referenced SOP Instance UID	(0008,1155)	M/M	UI	1	
Film Orientation	(2010,0040)	U/M	CS	1	Default is LANDSCAPE
Film Size ID	(2010,0050)	U/M	CS	1	Default is 14INX17IN
Magnification Type	(2010,0060)	U/M	CS	1	Default is REPLICATE
Trim	(2010,0140)	U/U	CS	1	Default is YES

If creation of the Basic Film Box fails, the Print SCU releases the association with the printer. The Print SCU never creates more than a single Basic Film Box in the context of one association. The Print SCU uses an N-ACTION-RQ message to request processing of the print job from the Print SCP. After a successful completion of the print job, the Print SCU uses an N-DELETE-RQ message to delete the Basic Film Box SOP instance before deleting the Basic Film Session SOP instance and releasing the association. Other requests are never sent.

As part of creation of the Basic Film Box SOP Instance, the Print SCP creates an Instance of the Basic Grayscale Image Box SOP Class. The Print SCU uses an N-SET DIMSE Service Element to update the Basic Grayscale Image Box SOP Instance. The following elements are sent as part of the N-SET DIMSE Service Element:

Attribute Name	Tag	Type	VR	VM	Comment
Image Position	(2020,0010)	M/M	US	1	
Basic Grayscale Image Sequence	(2020,0110)	M/M	SQ	1	
>Samples Per Pixel	(0028,0002)	M/M	US	1	Value is 1
>Photometric Interpretation	(0028,0004)	M/M	CS	1	Value is MONOCHROME2
>Rows	(0028,0010)	M/M	US	1	
>Columns	(0028,0011)	M/M	US	1	
>Pixel Aspect Ratio	(0028,0034)	MC/M			Sent if pixel aspect ratio is not 1\1
>Bits Allocated	(0028,0100)	M/M	US	1	Value is 8
>Bits Stored	(0028,0101)	M/M	US	1	Value is 8
>High Bit	(0028,0102)	M/M	US	1	Value is 7
>Pixel Representation	(0028,0103)	M/M	US	1	Value is 0
>Pixel Data	(7FE0,0010)	M/M	OW	1	
Polarity	(2020,0020)	U/M	CS	1	Default is NORMAL

5.3.4 Association Acceptance Policy

Not applicable, as the DVS software cannot accept incoming Associations. The DVS software as Print SCP is not implemented.

6. COMMUNICATION PROFILES

6.1 Supported Communication Stacks

DICOM Upper Layer of TCP/IP is supported. The DICOM Toolkit used is the OFFIS DCMTK Toolkit, version 3.5.2

6.1.1 OSI Stack

Not supported.

6.1.2 TCP/IP Stack

The TCP/IP stack from the underlying Operating System is used. Port 104 is used by all SCUs.

7. EXTENSIONS, SPECIALIZATIONS AND PRIVATIZATIONS

7.1 Standard Extensions

7.1.1 Standard Extension to DX Image for Storage SOP Class

The following attributes from other SOP classes are added to the DX Image for Storage SOP Instance:

Attribute Name	Tag	VR	VM	Comment
Scan Speed	(0018,1300)	DS	1	Taken from NM Image IOD