DICOM 3.0
Conformance Statement

For

(WAS)
Witt Archival System v1.05

Revision 1.4
August 11, 2004

SAL 0300/3/00-F22

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Revision History

Revision	Date	Author	Reason for Change
1.0	8/17/01	CM	Preliminary version
1.1	12/17/01	CM	Module addition
1.2	1/21/01	CM	Presentation Syntax Table
1.3	11/12/03	CM	Typographical changes
1.4	8/11/04	JC	Typographical changes

Copyright Statement

Disclaimer

Witt Biomedical certifies that the WAS software is in compliance with the ACR-NEMA DICOM 3.0 standard. However, due to the flexibility of DICOM, the user and/or company must perform integration testing to verify that the WAS is compatible and meets the requirements of the integration with another system. The testing must include but not be limited to sending DICOM Datasets (images/video) for all type of images you wish to transfer. If the results of your testing are not conclusive please contact your representative to guide you through your testing process.

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1. Introduction

1.1 Scope

This document states the conformance statement of Witt Biomedical DICOM compliant software/hardware family to DICOM 3.0 standard. It applies to:

Witt Archival System (Hereinafter WAS):
- o Verification Module
- o Store Module
- o Query & Retrieve Module

Please note that each module has its own capabilities, which are identified when considered appropriate.

1.2 Content Structure

The DICOM conformance statement consists of sections 2 through 7. It follows the content requirements of DICOM PS 3.2

1.3 Intended Audience

This Conformance Statement is intended for software engineers, system integrators, field engineers, and biomedical technicians. The audience is assumed to have a practical and working knowledge of DICOM standard and software interfaces in general.

1.4 Requirements and Use

Since the DICOM interface option and/or modules are not available if not purchased, System integrators who wish to implement a DICOM compliant hardware device and/or software from another manufacturer, need to contact the appropriate authority to activate or purchase the appropriate options/modules. In some circumstance hardware upgrade might be required to accommodate such options.

1.5 Acronyms and abbreviations

The following acronyms and abbreviations are used in this Conformance Statement:

AE	Application Entity
DICOM	Digital Imaging and Communication in Medicine
FIFO	First In First Out
HL7	Health Level Seven
IP	Internet Protocol
JPEG	Joint Photographic Experts Group (compression format)
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
Q/R	Query and Retrieve
WAS	Witt Archival System

2. Implementation Model Verification

In order for WAS Image Storage service to verify if it can request a connection and establish one, it must perform a verification request. Foreign applications (SCP) are responsible to respond to such a request. If such a request fails, make sure that Was Image Store is configured on the foreign AE configuration.

3. Implementation Model

Each DICOM SCU and SCP is an Application Entity (AE).

3.1 Application Data Flow Diagram

3.1.1 Verification Application Entity as an SCU
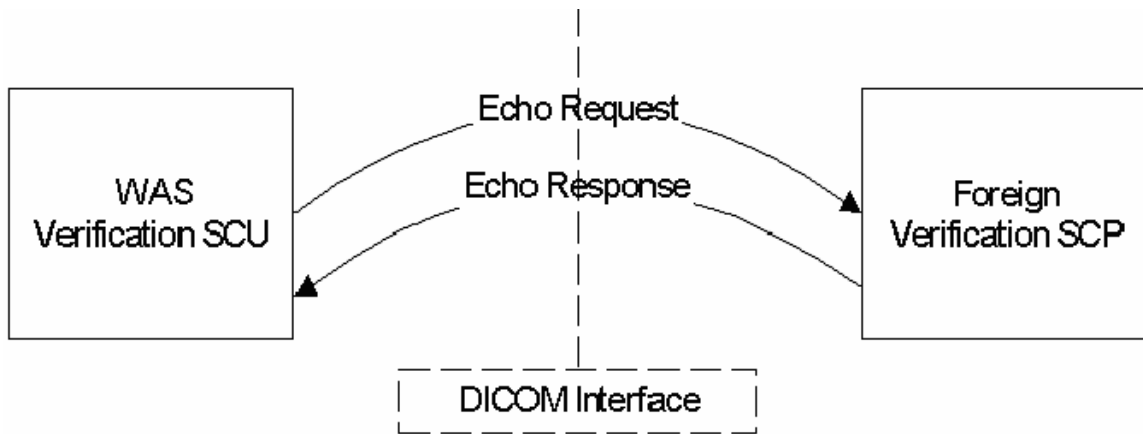
3.1.1.1 Presentation Context Table

Any presentation contexts found in the following reference table are provided for the DICOM Store SCU to send a verification request (C-ECHO).

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Verification	1.2.840.10008.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

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3.1.2 Image Storage Application Entity as an SCU
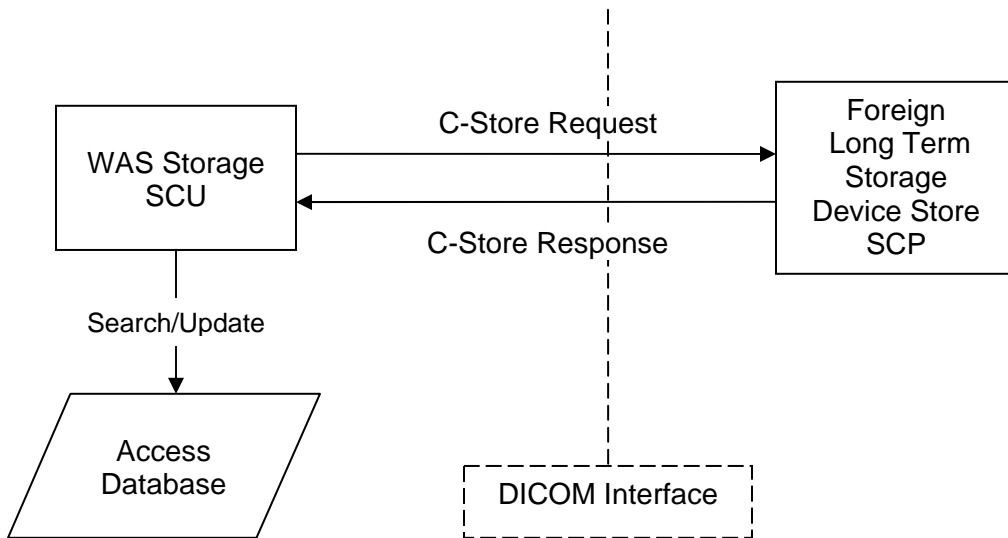
3.1.2.1 Presentation Context Table

Here is a list of image storage classes provided by the Image Storage AE. Any of the presentation contexts in the following table are provided by the DICOM Store SCU to send images (C-STORE).

Presentation Context						
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation	
Name	UID	Name	UID			
Media Storage Directory Storage	1.2.840.10008.1.3.10	See Table below	See Table below	SCU	None	
Basic Study Content Notification Class	1.2.840.10008.1.9	See Table below	See Table below	SCU	None	
Storage Commitment Push Model Class	1.2.840.10008.1.20.1	See Table below	See Table below	SCU	None	
Storage Commitment Pull Model Class	1.2.840.10008.1.20.2	See Table below	See Table below	SCU	None	
Detached Patient Management Class	1.2.840.10008.3.1.2.1.1	See Table below	See Table below	SCU	None	
Detached Patient Management Meta Class	1.2.840.10008.3.1.2.1.4	See Table below	See Table below	SCU	None	
Detached Visit Management Class	1.2.840.10008.3.1.2.2.1	See Table below	See Table below	SCU	None	
Detached Study Management Class	1.2.840.10008.3.1.2.3.1	See Table below	See Table below	SCU	None	
Study Component Management Class	1.2.840.10008.3.1.2.3.2	See Table below	See Table below	SCU	None	
Modality Performed Procedure Step Class	1.2.840.10008.3.1.2.3.3	See Table below	See Table below	SCU	None	
Modality Performed Procedure Step Retrieve Class	1.2.840.10008.3.1.2.3.4	See Table below	See Table below	SCU	None	
Modality Performed Procedure Step Notification Class	1.2.840.10008.3.1.2.3.5	See Table below	See Table below	SCU	None	
Detached Results Management Class	1.2.840.10008.3.1.2.5.1	See Table below	See Table below	SCU	None	
Detached Results Management Meta Class	1.2.840.10008.3.1.2.5.4	See Table below	See Table below	SCU	None	
Detached Study Management Meta Class	1.2.840.10008.3.1.2.5.5	See Table below	See Table below	SCU	None	

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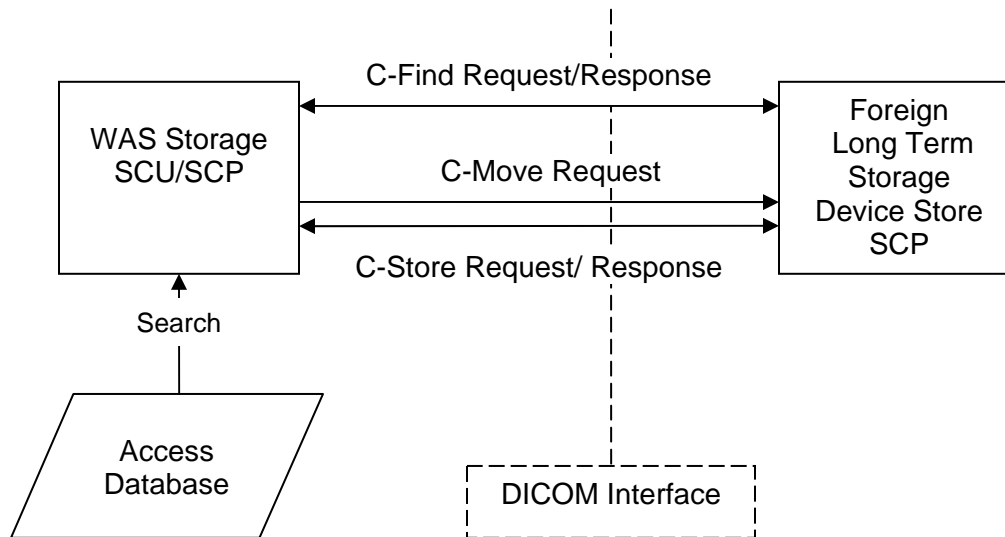
Detached Interpretation Management Class	1.2.840.10008.3.1.2.6.1	See Table below	See Table below	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	See Table below	See Table below	SCU	None
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2	See Table below	See Table below	SCU	None
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	See Table below	See Table below	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	See Table below	See Table below	SCU	None
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4	See Table below	See Table below	SCU	None
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	See Table below	See Table below	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	See Table below	See Table below	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	See Table below	See Table below	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See Table below	See Table below	SCU	None
Standalone Overlay Storage	1.2.840.10008.5.1.4.1.1.8	See Table below	See Table below	SCU	None
Standalone Curve Storage	1.2.840.10008.5.1.4.1.1.9	See Table below	See Table below	SCU	None
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10	See Table below	See Table below	SCU	None
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	See Table below	See Table below	SCU	None
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	See Table below	See Table below	SCU	None
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3	See Table below	See Table below	SCU	None
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	See Table below	See Table below	SCU	None
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	See Table below	See Table below	SCU	None
Standalone Positron Emission Tomography Curve Storage	1.2.840.10008.5.1.4.1.1.129	See Table below	See Table below	SCU	None
Radiotherapy Image Storage	1.2.840.10008.5.1.4.1.1.481.1	See Table below	See Table below	SCU	None
Radiotherapy Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	See Table below	See Table below	SCU	None
Radiotherapy Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	See Table below	See Table below	SCU	None
Radiotherapy Beams Treatment Record Storage Class	1.2.840.10008.5.1.4.1.1.481.4	See Table below	See Table below	SCU	None
Radiotherapy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	See Table below	See Table below	SCU	None
Radiotherapy Brachy Treatment Record Storage Class	1.2.840.10008.5.1.4.1.1.481.6	See Table below	See Table below	SCU	None
Radiotherapy Treatment Summary Record Storage Class	1.2.840.10008.5.1.4.1.1.481.7	See Table below	See Table below	SCU	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	See Table below	See Table below	SCU	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	See Table below	See Table below	SCU	None
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	See Table below	See Table below	SCU	None
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	See Table below	See Table below	SCU	None
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	See Table below	See Table below	SCU	None
Digital Intra-oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	See Table below	See Table below	SCU	None
Visible Light Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1	See Table below	See Table below	SCU	None
Visible Light Multiframe Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2	See Table below	See Table below	SCU	None
Visible Light Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77	See Table below	See Table below	SCU	None

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Class	.1.1				
Visible Light Microscopic Image Storage Class	1.2.840.10008.5.1.4.1.1.77 .1.2	See Table below	See Table below	SCU	None
Visible Light Slide-Coordinates Microscopic Image Storage Class	1.2.840.10008.5.1.4.1.1.77 .1.3	See Table below	See Table below	SCU	None
Visible Light Photographic Image Storage Class	1.2.840.10008.5.1.4.1.1.77 .1.4	See Table below	See Table below	SCU	None
Basic Text Structured Reporting	1.2.840.10008.5.1.4.1.1.88 .11	See Table below	See Table below	SCU	None
Enhanced Structured Reporting	1.2.840.10008.5.1.4.1.1.88 .22	See Table below	See Table below	SCU	None
Comprehensive Structured Reporting	1.2.840.10008.5.1.4.1.1.88 .33	See Table below	See Table below	SCU	None
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9. 1.3	See Table below	See Table below	SCU	None
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9. 2.1	See Table below	See Table below	SCU	None
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9. 3.1	See Table below	See Table below	SCU	None
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9. 4.1	See Table below	See Table below	SCU	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11 .1	See Table below	See Table below	SCU	None

Each of the storage SOP classes listed above can be transferred using one of the following transfer syntaxes.

Transfer Syntax Name	UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Default Lossy JPEG Compressed	1.2.840.10008.1.2.4.50
Default Lossless JPEG Compressed	1.2.840.10008.1.2.4.70
RLE Compressed	1.2.840.10008.1.2.5
Others (Optional)	
Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Extended (Process 3 & 5)	1.2.840.10008.1.2.4.52
JPEG Spectral Selection, Non-Hierarchical (Process 6 & 8)	1.2.840.10008.1.2.4.53
JPEG Spectral Selection, Non-Hierarchical (Process 7 & 9)	1.2.840.10008.1.2.4.54
JPEG Full Progression, Non-Hierarchical (Process 10 & 12)	1.2.840.10008.1.2.4.55
JPEG Full Progression, Non-Hierarchical (Process 11 & 13)	1.2.840.10008.1.2.4.56
JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57
JPEG Lossless, Non-Hierarchical (Process 15)	1.2.840.10008.1.2.4.58
JPEG Extended, Hierarchical (Process 16 & 18)	1.2.840.10008.1.2.4.59
JPEG Extended, Hierarchical (Process 17 & 19)	1.2.840.10008.1.2.4.60
JPEG Spectral Selection, Hierarchical (Process 20 & 22)	1.2.840.10008.1.2.4.61
JPEG Spectral Selection, Hierarchical (Process 21 & 23)	1.2.840.10008.1.2.4.62
JPEG Full Progression, Hierarchical (Process 24 & 26)	1.2.840.10008.1.2.4.63
JPEG Full Progression, Hierarchical (Process 25 & 27)	1.2.840.10008.1.2.4.64
JPEG Lossless, Hierarchical (Process 28)	1.2.840.10008.1.2.4.65
JPEG Lossless, Hierarchical (Process 29)	1.2.840.10008.1.2.4.66

3.1.3 Query/Retrieve Application Entity as an SCU/SCP

```
                              C-Find Request/Response
        ┌──────────────┐ ◄──────────────────────────────► ┌──────────────┐
        │              │                                   │   Foreign    │
        │  WAS Storage │                                   │  Long Term   │
        │   SCU/SCP    │          C-Move Request           │   Storage    │
        │              │ ─────────────────────────────────►│ Device Store │
        │              │                                   │     SCP      │
        │              │ ◄──────────────────────────────► │              │
        └──────────────┘  C-Store Request/ Response        └──────────────┘
                ▲
             Search
                │
          ┌─────────────┐              ┌─────────────────┐
         ╱   Access      ╱             │ DICOM Interface │
        ╱   Database    ╱              └─────────────────┘
       └─────────────┘
```

3.1.3.1 Provided Query/Retrieve SOP Class

WAS provides Standard Conformance to the following DICOM V3.0 **Query/Retrieve** SOP Class as an SCU/SCP (Client/Server).

Description	SOP Class UID
Patient Root Query/Retrieve C-FIND Request	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve C-MOVE Request	1.2.840.10008.5.1.4.1.2.1.2

3.2 Functional Definition of AE

3.2.1 Verification Application Entity

The Verification AE is a SCU module that sends a DICOM 3.0 verification request to a remote Verification AE SCP. Upon connection it sends a request to the remote Verification AE based on the WAS current configuration.

The response can be one of the following:
- Success (Remote AE Accepted by SCP)
- Rejected (Remote AE Rejected by SCP)

The response is based on an internal query of acceptable remote AE connections.

3.2.2 Image Storage Application Entity

The Image Storage AE uses DICOM 3.0 Storage service (SCU) to store single and multi-frame image/video. Supported image/video SOP CLASS are described in section 3.1.2.

WAS can transmit as a configured AE Title SCU.

WAS will transmit the image "as-is" without modification of its type (RLE, JPEG…) or attributes unless the image's transfer syntax in not accepted by the storage AE.

3.2.3 Q/R Application Entity

The Query and Retrieve AE uses DICOM 3.0 Q/R service (SCU) to query stored studies and DICOM 3.0 Store (SCP) to retrieve selected images. Supported image/video SOP CLASS are described in section 3.1.3.

WAS Q/R service issues a C-FIND command based on the Patient Root query class. Once the local query is processed by the Q/R SCP, the information is received in DICOM format by the Q/R SCU. WAS will populate the following fields:

Data Item	(Group, Element)
Patient Level	
Patient ID	(0010,0020)
Study Level	
Study Instance UID	(0020,000D)
Series Level	
Series Instance UID	(0020,000E)
Image Level	
SOP Instance UID	(0008,0018)

From that point the WAS Q/R SCU will send a C-MOVE command to the Q/R SCP. The Q/R SCP receives the appropriate command and appends a record to the STORE SCU queue, which will send the requested file to the specified WAS STORE SCP.

3.3 Supported Protocol Stacks (parts 8, 9)

WAS network apparatus are all using DICOM upper layer protocol as defined in Parts 8 and 9 of DICOM standard.

Our system is using TCP/IP stack on all DICOM compliant devices including print. (Excluding physical media transfer on CD-R, DVD, MO)

3.4 TCP/IP Stack

WAS devices are all using TCP/IP stack via Microsoft Windows Winsock interface.

3.5 Physical Media Support

Witt Biomedical recommends using at least 100BASE-T (IEEE 802.3) network and network devices. Slower network, such as 10BASE-T, would provide unacceptable user response times for almost all modality data sets.

4. Configuration

Every AE can configure the following parameters:
- Acceptable foreign SCP (IP Address and/or AE Title)
- Port number for SCU & SCP
- Proprietary Network Information
- Used Presentation Contexts
- Used Transfer Syntaxes

4.1 Verification AE

4.2 Image Storage AE

4.3 Query/Retrieve AE

5. Support of Basic/Extended Character Sets

WPS supports the following character set: ISO-IR (100) Latin alphabet #1