

Technical Publications

**Direction DOC1806913
Revision 01**

Invenia ABUS Scan Station 1.X.X DICOM CONFORMANCE STATEMENT

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CONFORMANCE STATEMENT OVERVIEW

Invenia Automated Breast Ultrasound System Scan Station collects the ultrasound data. On the scan station patient information can be entered manually or patients may be selected from a list that is generated from information obtained using the DICOM Modality Worklist.

Table 0.1 provides an overview of the network services supported by Invenia ABUS Scan Station.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Multi-frame Image Storage	Yes	No
Grayscale Softcopy Presentation State Storage	Yes	No
Workflow Management		
Modality Worklist	Yes	No
Modality Performed Procedure Step	Yes	No

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1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

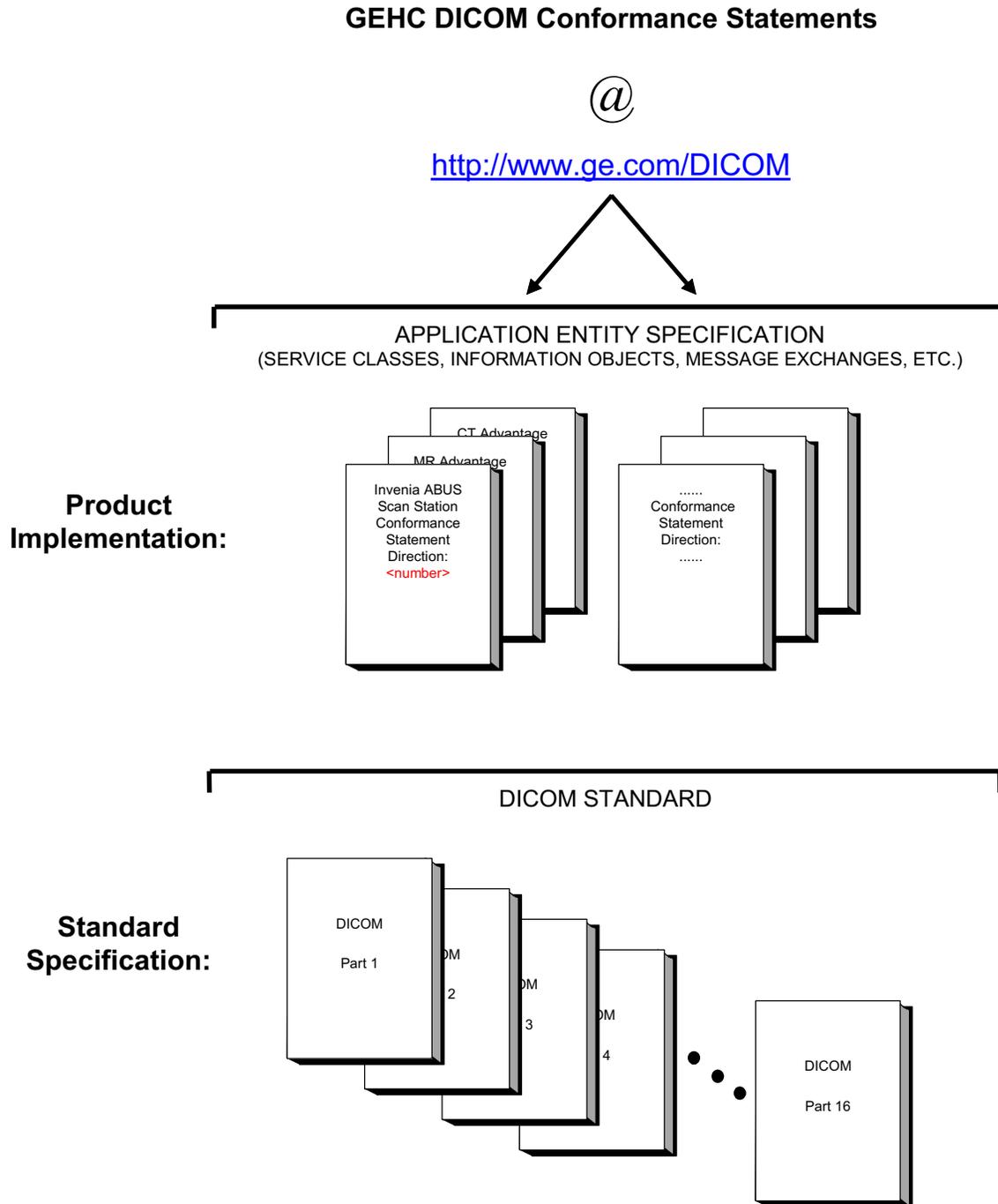
Section 3 (US Information Object Implementation), which specifies the use of the DICOM US Image IOD to represent the information included in US Images produced by this implementation. Corresponding attributes are conveyed using the module construct.

Section 4 (Modality Worklist Information Model), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.

Section 5 (Modality Performed Procedure Step Information Model), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the MPPS service.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

*Invenia ABUS Scan Station 1.X.X
Conformance Statement for DICOM
Direction DOC1806913*

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

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

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1752
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

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

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

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

1.5 IMPORTANT REMARKS

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

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or Review Software.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

NEMA PS3	Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/
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1.7 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.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
ANSI	American National Standards Institute
DICOM	Digital Imaging and Communications in Medicine
DOB	Date Of Birth
IEEE	Institute of Electrical and Electronics Engineers
IOD	Information Object Definition
LAN	Local Area Network
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
VR	Value Representation
ABUS	Automated Breast Ultrasound System

The following terms are used in various tables to indicate how attributes are used.

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value
ABSENT	Attribute is not used.

The following terms are used in various tables to indicate the source of attributes.

MWL	The attribute value source Modality Worklist
USER	The attribute value source is from User input
AUTO	The attribute value is generated automatically
MPPS	The attribute value is the same as that use for Modality Performed Procedure Step
CONFIG	The attribute value source is a configurable parameter

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Invenia ABUS Scan Station compliance to DICOM requirements for **Networking** features.

2.2 IMPLEMENTATION MODEL

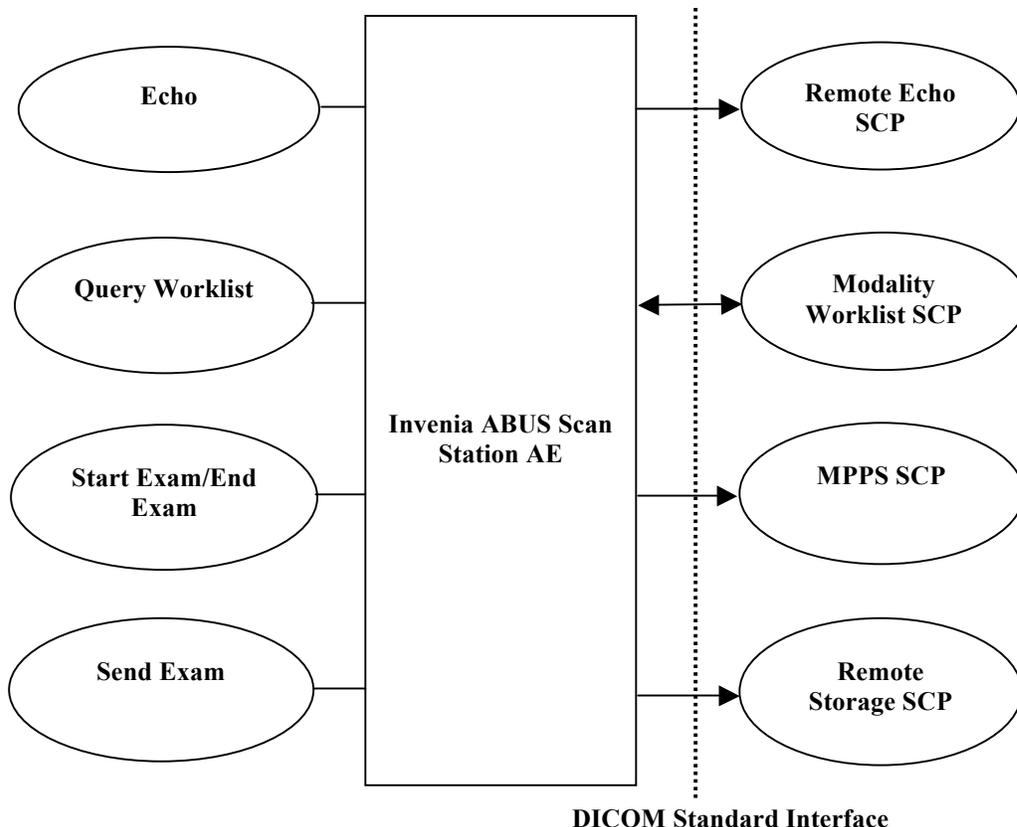
The Scan Station stores images and patient data directly on the system's hard disk. All images and patient data are retained locally on the system (storage space permitting) allowing this data to be sent or re-sent at the operators' discretion to the Invenia ABUS Review Software or a DICOM storage server.

2.2.1 Application Data Flow Diagram

The network application model for the Invenia ABUS Scan Station is shown in the following Illustration :

ILLUSTRATION 2-1

Invenia ABUS Scan Station Network Application Model and Data Flow Diagram



Query Worklist performs a query to the remote DICOM SCP and retrieves the matching worklist items.

Start Exam /End Exam create and complete the MPPS for the exam and update the remote DICOM SCP.

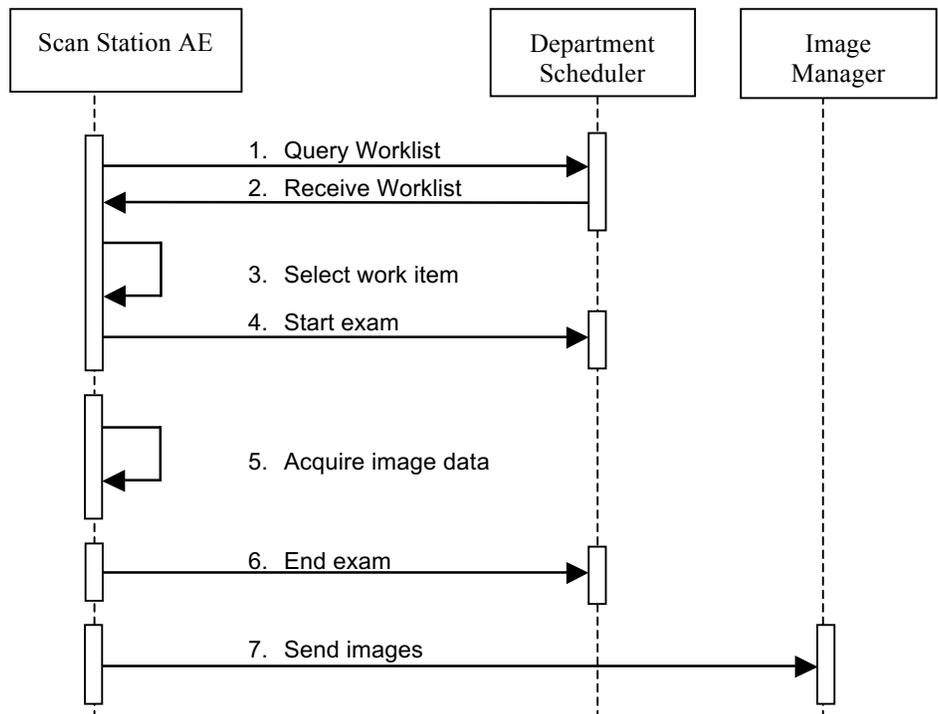
Send Exam transmits images to the remote DICOM SCP.

Echo requests verification to the remote DICOM SCP. Functional Definition of AE's

2.2.2 Functional Definition of AE's

The Scan Station has a single AE that performs all the required DICOM related tasks.

2.2.3 Sequencing of Real-World Activities



Under normal scheduled workflow conditions the sequencing constraints illustrated in Figure 2 apply:

1. Query Worklist for matching items
2. Receive Worklist matches
3. Select item from the Worklist
4. Start exam initiates the MPPS creation and setting of the status to in progress.
5. Acquire image data (multi frame images)
6. End exam initiate the MPPS status to be set to completed.
7. Send images to the image manager.

Other workflow situations (e.g. unscheduled procedure steps) will have other sequencing constraints. Storage could be omitted completely if no image manager is connected.

2.3 AE SPECIFICATIONS

2.3.1 Scan Station AE Specification

The Scan Station Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU and/or as an SCP:

SOP Class Name	SOP Class UID	SCU	SCP
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	No
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No
Verification SOP Class	1.2.840.10008.1.1	Yes	No
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	No

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1
---------------------------------	------------------------------

The maximum length PDU receive size for the Scan Station AE is:

Maximum Length PDU	4
---------------------------	----------

2.3.1.1.2 Number of Associations

The Scan Station AE will initiate a maximum of 4 simultaneous associations to remote nodes.

The Scan Station AE will support a maximum of 4 associations initiated by remote nodes.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Scan Station AE Implementation UID	2.16.840.1.114241.1
Scan Station AE Implementation Version Name	USI_V2.0

2.3.1.2 Association Initiation Policy

When the Scan Station Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The Scan Station AE proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

2.3.1.2.1 Real-World Activity Send Exam

Although there are three ways a user, or the system, can initiate the storing of an image the association initiation and image transfer process are identical.

2.3.1.2.1.1 Description and Sequencing of Activity

An association is established when one of the actions shown below occurs.

- Selecting the Resend button from the worklist screen.
- Selecting the Next Patient button in the verification screen.
- Selecting the Log out button in the screen.

In each case a new association is opened for the transfer of each individual image. On completion of the transfer successful or otherwise the association is closed.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Scan Station for Activity Send Exam					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement to Ultrasound Multi-frame Image Storage SOP Classes

The Ultrasound Image Storage SOP Classes allow the encoding of a curve, rather than an image, in the SOP Instances.

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700–A7FF	Out of Resources	The image transfer has failed. Association is closed and the DICOM send status indicator is set to red (transfer error). Any error information is logged.	(0000,0902)
	A900–A9FF	Data Set does not match SOP Class		(0000,0901) (0000,0902)
	C000-CFFF	Cannot understand		(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	The image transfer has completed. The association is closed and the DICOM send status indicator is set to green (no errors).	(0000,0901) (0000,0902)
	B007	Data Set does not match SOP Class		(0000,0901) (0000,0902)
	B006	Elements Discarded		(0000,0901) (0000,0902)
Success	0000	Success	The image transfer has completed. The association is closed and the DICOM send status indicator is set to green (no errors).	None

2.3.1.2.1.2.1.1 Ultrasound Multi-frame Image Storage Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	The image transfer has failed. The DICOM send status indicator is set to red (transfer error). Any error information is logged.
Association A-REJECTEd by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	

2.3.1.2.2 Real-World Activity Echo

Before sending an image to a server, the association initiation is required to check the connection between scan station and the server. If the association initiation failed, a retry mechanism is initiated and started to check the connection again.

2.3.1.2.2.1 Description and Sequencing of Activity

An association is established when one of the actions shown below occurs.

- Selecting the Resend button from the worklist screen.
- Selecting the Next Patient button in the verification screen.
- Selecting the Log out button in the screen.

In each case a new association is opened for the transfer of each individual image. On completion of the transfer successful or otherwise the association is closed.

2.3.1.2.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE Scan Station AE for Activity Echo					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

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2.3.1.2.2.2.1 SOP Specific Conformance to Verification SOP Class

2.3.1.2.2.2.1.1 Verification C-ECHO Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The association is closed.

2.3.1.2.2.2.1.2 Verification Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	The color of the status indicator changes to red. Any error information is logged.
Association A-REJECTEd by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the Windows 7 64 Bit Operating System.

2.4.2 Physical Media Support

The ABUS Review Software supports a single network interface. One of the following physical network interfaces will be available:

Supported Physical Network Interface

Ethernet 1000baseT
Ethernet 100baseT

The Scan Station only supports IPv4 connections.

2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

Specialized or private SOP classes are not supported.

2.5.2 Ultrasound Multi-frame Image Storage SOP Class

The Ultrasound Multi-frame Image Storage SOP Class is extended to create a Standard Extended SOP Class by addition of private attributes to the created SOP Instances as documented in section 3.

2.5.3 Private Transfer Syntaxes

No Private Transfer Syntax is supported.

2.6 CONFIGURATION

Parameter	User Configurable (Yes/No)	Service Configurable (Yes/No)	Default Value
General Parameters			
Supported Transfer Syntaxes	No	No	Explicit VR Little Endian Explicit VT Big Endian Implicit VR Little Endian
Maximum PDU receive size	No	No	16kB
Maximum PDU send size	No	No	16kB (smaller sizes are negotiated per association)
Timeout waiting for acceptance or rejection response to an Association Open Request	No	No	20s
General DIMSE level time-out values	No	No	Infinite
Modality Worklist Parameters			
Maximum number of Worklist Items	No	No	10000
Query Worklist for specific Modality Value	Yes	Yes	“US”
Query Worklist for specific Scheduled Station AE Title	Yes	Yes	“ABUSApp”
Query Worklist for Scheduled Procedure Step Start Date	Yes	Yes	Current Week

There are many DICOM and networking parameters that can be changed on the Scan Station. The user can change many of these settings but there are some that can only be changed by a GE authorized service representative.

2.6.1 AE Title/Presentation Address Mapping

2.6.2 Configurable Parameters

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

- Local AE Title
- Local IP Address
- Local Listening Port Number and its values are not configurable.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

NOTE : All configurations must be performed by a GE Field Engineer

TABLE 2-1 CONFIGURATION PARAMETERS

2.7 SUPPORT OF EXTENDED CHARACTER SETS

The ABUS scan station support character set ISO_IR 100 and ISO_IR 192.

2.8 CODES AND CONTROLLED TERMINOLOGY

The Scan Station AE is capable of supporting arbitrary coding schemes for Procedure and Protocol Codes. The contents of Requested Procedure Code Sequence (0032,1064) and Scheduled Protocol Code Sequence (0040,0008) supplied in Worklist Items will be mapped to Image IOD attributes as described in Table 3-14.

2.9 SECURITY PROFILES

The Scan Station does not support any specific security measures. It is assumed that the Scan Station is used within a secured environment that includes at a minimum:

- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))

Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

3. US MULTI-FRAME INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM US Image IOD to represent the information included in US Images produced by this implementation. Corresponding attributes are conveyed using the module construct.

3.2 INVENIA ABUS SCAN STATION MAPPING OF DICOM ENTITIES

The Invenia ABUS Scan Station maps DICOM Information Entities to local Information Entities in the product’s database and user interface.

TABLE 3-1
MAPPING OF DICOM ENTITIES TO INVENIA ABUS SCAN STATION ENTITIES

DICOM IE	Invenia ABUS Scan Station Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

3.3 IOD MODULE TABLE

The Ultrasound Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section 0.

TABLE 3-2
US IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Absent	NA
Study	General Study	Used	3.4.2.1
	Patient Study	Used	NA
	Clinical Trial Study	Absent	NA
Series	General Series	Used	3.4.3.1
	Clinical Trial Series	Absent	NA

Frame of Reference	Frame of Reference	Absent	<u>3.4.4</u>
	Synchronization	Absent	NA
Equipment	General Equipment	Used	<u>3.4.5.1</u>
Image	General Image	Used	<u>3.4.7.1</u>
	Image Pixel	Used	<u>3.4.7.2</u>
	Contrast/Bolus	Absent	NA
	Cine	Used	<u>3.4.7.3</u>
	Multi-frame	Used	<u>3.4.7.4</u>
	Frame Pointers	Absent	NA
	Palette Color Lookup Table	Absent	NA
	Device	Absent	NA
	US Region Calibration	Absent	NA
	US Image	Used	<u>3.4.7.5</u>
	Overlay Plane	Absent	NA
	VOI LUT	Absent	NA
	SOP Common	Used	<u>3.4.7.6</u>
Image Plane	Used	<u>3.4.7.7</u>	

3.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the US Information Object.

3.4.1.1 Patient Module

TABLE 3-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From MWL or entered from user interface VNAP
Patient ID	(0010,0020)	2	From MWL or entered from user interface VNAP
Patient's Birth Date	(0010,0030)	2	From MWL or entered from user interface VNAP
Patient's Sex	(0010,0040)	2	Always "F" ALWAYS
Other Patient IDs	(0010,1000)	3	An ID generated by the Scan Station Always
Patient comment	(0010,4000)	3	User-defined additional information about the patient.

3.4.2 Study Entity Modules

3.4.2.1 General Study Module

TABLE 3-4
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From MWL or system generated ALWAYS
Study Date	(0008,0020)	2	Date when study was started ALWAYS
Study Time	(0008,0030)	2	Time when study was started ALWAYS
Referring Physician's Name	(0008,0090)	2	From MWL VNAP
Study ID	(0020,0010)	2	From MWL or Manual Entry
Accession Number	(0008,0050)	2	From MWL VNAP
Study Description	(0008,1030)	3	From MWL VNAP

3.4.3 Series Entity Modules

3.4.3.1 General Series Module

TABLE 3-5
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"US"
Series Instance UID	(0020,000E)	1	System generated
Series Number	(0020,0011)	2	1
Series Date	(0008,0021)	3	Date when series was started
Series Time	(0008,0031)	3	Time when series was started
Operators' Name	(0008,1070)	3	Login user name

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3.4.4 Frame of Reference Module

This module is not used.

3.4.5 Equipment Entity Modules

3.4.5.1 General Equipment Module

**TABLE 3-6
GENERAL EQUIPMENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	“U-Systems” ALWAYS
Institution Name	(0008,0080)	3	Entered from user interface VNAP
Manufacturer's Model Name	(0008,1090)	3	“SomoV-Pro” ALWAYS
Software Versions	(0018,1020)	3	Scan Station software version ALWAYS

3.4.6 Image Entity Modules

3.4.6.1 General Image Module

**TABLE 3-7
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Image number in series, 1 through n ALWAYS
Content Date	(0008,0023)	2C	Date when image was acquired ALWAYS
Content Time	(0008,0033)	2C	Time when image was acquired ALWAYS
Image Type	(0008,0008)	3	ORIGINAL ALWAYS
Icon Image Sequence	(0088,0200)	3	This icon image is representative of the Image. Only a single Item is permitted in this Sequence.

3.4.6.2 Image Pixel Module

**TABLE 3-8
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	Image dependent
Columns	(0028,0011)	1	Image dependent
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Generated pixel data

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3.4.6.3 Cine Module Attributes

TABLE 3-9CINE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	100 ALWAYS

3.4.6.4 Multi-frame Module Attributes

**TABLE 3-10
MULTI-FRAME MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Image dependent
Frame Increment Pointer	(0028,0009)	1	Frame Time (0018,1063)

3.4.6.5 US Image Module

**TABLE 3-11
US IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Samples Per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0
Image Type	(0008,0008)	2	ORIGINAL
View Name	(0008,2127)	3	LUIQ RUIQ LLIQ RLIQ LUOQ RUOQ LLOQ RLOQ LSUP RSUP LINF RINF LMED RMED LLAT RLAT LAP RAP
Spacing Between Slices	(0018, 0088)		Spacing between two slices in mm
Private Creator	(0021,0010)		U-Systems
Nipple Position (Frame/X/Y)	(0021,1020)		Image dependent
First Element Position	(0021,1021)		Image dependent
Curvature Radius (Probe)	(0021,1040)		Image dependent
Curvature Radius (Track)	(0021,1041)		Image dependent
Steering Angle	(0021,1060)		Image dependent
Max Cut	(0021,1061)		Image dependent
Line Density	(0021,1062)		Image dependent

Scan Depth	(0021,1063)		Image dependent
ABUSApp build number	(0021,1064)		
Pressure	(0021,1090)		Image dependent
Tissue Equalization Algorithm	(0021,10A0)		True
SRI (speckle reduction imaging)	(0021,10A2)		
IQ (Image Quality) version	(0021,10B0)		Invenia1.2
Transducer Data	(0018,5010)	3	C15_6XW
Mechanical Index	(0018,5022)	3	
Soft Tissue Thermal Index	(0018,5027)	3	
Transducer Frequency	(0018,6030)	3	9

3.4.6.6 SOP Common Module

**TABLE 3-12
SOP COMMON MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.3.1
SOP Instance UID	(0008,0018)	1	System generated
Specific Character Set	(0008,0005)	1C	Define whether or not Specific Character Sets are ever created by SCU/FSC, and whether or not they are supported (and in what manner) any SCP/FSR. Defined Terms include: ISO_IR 100 = Latin Alphabet No. 1 ISO_IR 192 = Unicode in UTF-8

3.4.6.7 Image Plane Module Attributes

**TABLE 3-13
IMAGE PLANE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Pixel Spacing	(0028,0030)	DS	A numeric pair – adjacent row spacing and adjacent column spacing in mm

3.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The private attributes added to created SOP instances are listed in the Table 3-14 below. Scan Station reserves blocks of private attributes in group 0021. Further details on usage of these private attributes are contained in section 3.

Tag	Attribute Name	VR	VM
(0021,0010)	Private Creator	SH	1
(0021,1020)	Nipple Position (Frame/X/Y)	DS	3
(0021,1021)	First Element Position (L, R)	SH	1

Tag	Attribute Name	VR	VM
(0021,1040)	Curvature Radius (Probe)	DS	1
(0021,1041)	Curvature Radius (Track)	DS	1
(0021,1060)	Steering Angle	DS	1
(0021,1061)	Max Cut	DS	1
(0021,1062)	Line Density	DS	1
(0021,1063)	Scan Depth (cm)	DS	1
(0021,1064)	ABUSApp build number	SH	1
(0021,1090)	Pressure	SH	1
(0021,10A0)	Tissue Equalization Algorithm	SH	1
(0021,10A2)	SRI (speckle reduction imaging)	LO	1
(0021,10B0)	IQ (Image Quality) version	SH	1

3.6 ATTRIBUTE MAPPING

The relationships between attributes received via Modality Worklist and those stored in acquired images are summarized in Table 3-14.

**TABLE 3-14
 ATTRIBUTE MAPPING BETWEEN MODALITY WORKLIST AND IMAGE IOD'S**

Modality Worklist	Image IOD
Patient Name	Patient Name
Patient ID	Patient ID
Patient's Birth Date	Patient's Birth Date
Patient's Sex	Patient's Sex
Accession Number	Accession Number
Referring Physician's Name	Referring Physician's Name
Study Instance UID	Study Instance UID
Requested Procedure Description	Study Description
Modality	Modality
Study ID	Study ID

3.7 GRAYSCALE SOFTCOPY PRESENTATION STATE

3.7.1 ABUS Scan Station Mapping of DICOM Entities

The ABUS Scan Station maps DICOM Information Entities to local Information Entities in the product's database and user interface.

**TABLE 3-15
 MAPPING OF DICOM ENTITIES TO ABUS SCAN STATION ENTITIES**

DICOM IE	ABUS Scan Station Entity
Patient	Patient

Study	Exam
Series	Series
Presentation State	Presentation State

3.7.2 IOD Module Table

The Grayscale Softcopy Presentation State Information Object Definition comprises the modules of the following table.

**TABLE 3-16
 GSPS IOD MODULES**

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.7.3.1
Study	General Study	Used	3.7.3.2
Series	General Series	Used	3.7.3.3
	Presentation Series	Used	3.7.3.4
Presentation State	Presentation State Identification	Used	3.7.4.1
	Presentation State Relationship	Used	3.7.4.2
	Presentation State Shutter	Used	3.7.4.3
	Displayed Area	Used	3.7.4.4
	Softcopy Presentation LUT	Used	3.7.4.5
	SOP Common	Used	3.7.4.6

3.7.3 Information Module Definitions

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the GSPS Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes <supported> <and/or> <expected>. Type 1 & Type 2 Attributes are also included for completeness and to define <what values they may take and where these values are obtained from when generating the instance> <as well as> <what are the expected values when loading such instance>. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

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3.7.3.1 Patient Module

TABLE 3-17
 PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	
Patient ID	(0010,0020)	2	
Patient's Birth Date	(0010,0030)	2	
Patient's Sex	(0010,0040)	2	
Other Patient IDs	(0010,1000)	3	ABUS assigns a unique "Privacy Number"

3.7.3.2 General Study Module

TABLE 3-18
 GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	
Study Date	(0008,0020)	2	
Study Time	(0008,0030)	2	
Study ID	(0020,0010)	2	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	3	
Referring Physician's Name	(0008,0090)	2	
Manufacturer	(0008,0070)	2	

3.7.3.3 General Series Module

TABLE 3-19
 GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	2	
Series Date	(0008,0021)	3	
Series Time	(0008,0031)	3	
Performing Physicians' Name	(0008,1050)	3	

3.7.3.4 Presentation Series Module

TABLE 3-20
 PRESENTATION SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Value = PR

3.7.4 Presentation State Entity Modules

3.7.4.1 Presentation State Identification Module

**TABLE 3-21
PRESENTATION STATE IDENTIFICATION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Presentation Creation Date	(0070,0082)	1	AUTO
Presentation Creation Time	(0070,0083)	1	AUTO
Instance Number	(0020,0013)	1	AUTO
Content Label	(0070,0080)	1	AUTO
Content Description	(0070,0081)	2	AUTO
Content Creator's Name	(0070,0084)	2	BLANK

3.7.4.2 Presentation State Relationship Module

**TABLE 3-22
PRESENTATION STATE RELATIONSHIP MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Referenced Series Sequence	(0008,1115)	1	Used
>Series Instance UID	(0020,000E)	1	Input Value
>Referenced Image Sequence	(0008,1140)	1	Used
>>Referenced SOP Class UID	(0008,1150)	1	Input Value
>>Referenced SOP Instance UID	(0008,1155)	1	Input Value
>>Referenced Frame Number	(0008,1160)	1C	Input Value 1\2\3\...\330 330 is the current maximum frame number

3.7.4.3 Presentation State Shutter Module

**TABLE 3-24
PRESENTATION STATE SHUTTER MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Use
Shutter Presentation Value	(0018,1622)	1C	
Shutter Presentation Color CIELab Value	(0018,1624)	1C	

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3.7.4.4 Displayed Area Module

TABLE 3-25
 DISPLAYED AREA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Displayed Area Selection Sequence	(0070,005A)	1	Used
>Referenced Image Sequence	(0008,1140)	1C	Used
>>Referenced SOP Class UID	(0008,1150)	1	Input Value
>>Referenced SOP Instance UID	(0008,1155)	1	Input Value
>>Referenced Frame Number	(0008,1160)	1C	Input Value 1\2\3...\330 (maximum frame number)
>Displayed Area Top Left Hand Corner	(0070,0052)	1	Input Value
>Displayed Area Bottom Right Hand Corner	(0070,0053)	1	Input Value
>Presentation Size Mode	(0070,0100)	1	SCALE TO FIT
>Presentation Pixel Spacing	(0070,0101)	1C	Input Value 0.082\0.200 (Pixel spacing) Unit: mm

3.7.4.5 Softcopy Presentation LUT Module

TABLE 3-26
 SOFTCOPY PRESENTATION LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Presentation LUT Shape	(2050,0020)	1C	IDENTITY

3.7.4.6 SOP Common Module

TABLE 3-27
 SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Input Value
SOP Instance UID	(0008,0018)	1	Input Value
Specific Character Set	(0008,0005)	1C	ISO_IR 100 = Latin Alphabet No. 1
Instance Creation Date	(0008,0012)	3	AUTO
Instance Creation Time	(0008,0013)	3	AUTO
Instance Number	(0020,0013)	3	Input Value

3.7.5 Private Group GEMS_0021

PRIVATE GROUP GEMS_0021

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0021,0011)	LO	1	U-System
Breast border	(0021,1100)	OB	1	Binary data

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Breast Border 2D	(0021,1101)	OB	1	Binary data
Chest Wall	(0021,1110)	OB	1	Binary data
Rib	(0021,1120)	OB	1	Binary data
Lesion Detection	(0021,1121)	OB	1	Binary data
Calcification	(0021,1122)	OB	1	Binary data
Histogram Peak Value	(0021,1130)	FD	1	float
Histogram Lower Range	(0021,1132)	FD	1	float
Histogram Upper Range	(0021,1133)	FD	1	float
Histogram Average SD	(0021,1134)	FD	1	float

4. MODALITY WORKLIST QUERY IMPLEMENTATION

4.1 INTRODUCTION

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed.

4.2 REAL-WORLD ACTIVITY QUERY WORKLIST

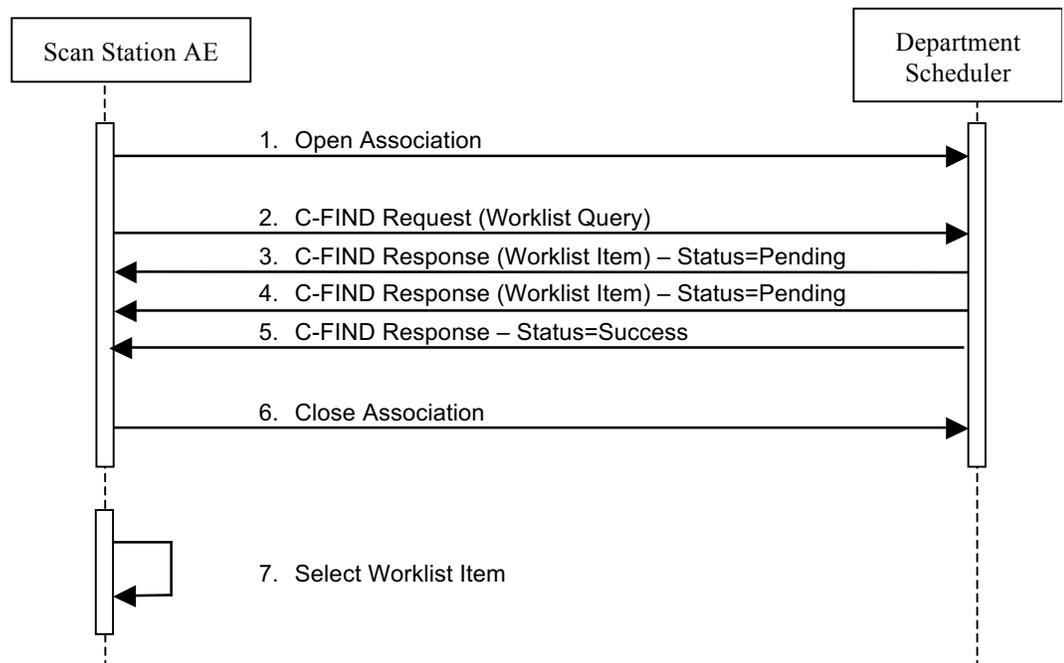
Although there are three ways a user, or the system, can initiate a worklist update the association initiation and data transfer are identical.

4.2.1 Description and Sequencing of Activity

An association is established when one of the actions shown below occurs.

- Selecting Refresh in the Worklist screen.
- User log in.
- Change Worklist configuration options in the Configuration screen.

In each case a new association is opened an identifier for the C-FIND request will be created and sent. The Scan Station AE then waits for responses and as they arrive adds new items to the users worklist display. On receiving the last C-FIND response or an error condition the association is closed.



A possible sequence of interactions between the Scan Station AE and a Departmental Scheduler (e.g. a device such as a RIS or HIS which supports the Modality Worklist SOP Class as an SCP) is illustrated in Figure 3 above:

1. The Scan Station AE opens an association with the Departmental Scheduler.
2. The Scan Station AE sends a C-FIND request to the Departmental Scheduler containing the Worklist Query attributes.
3. The Departmental Scheduler returns a C-FIND response containing the requested attributes of the first matching Worklist Item.
4. The Departmental Scheduler returns another C-FIND response containing the requested attributes of the second matching Worklist Item.
5. The Departmental Scheduler returns another C-FIND response with status Success indicating that no further matching Worklist Items exist. This example assumes that only 2 Worklist items match the Worklist Query.
6. The Scan Station AE closes the association with the Departmental Scheduler.
7. The query response records are retained by the Scan Station AE, with a subset of each response displayed to the user in a list. The user selects a case from that list, and the corresponding data from the record is used to populate the meta-data for that case (and hence is included in subsequent storage of that case).

4.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE Scan Station AE for Activity Query Worklist					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

4.2.3 SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model - FIND SOP Class

Following are the status codes the Application may send back to the SCU Equipment while performing the requested **Modality Worklist Query** :

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700	Refused: Out of resources	The association is closed or aborted. Any error information is logged.	(0000,0902)
	A900	Error: Identifier does not match SOP Class	The association is closed or aborted. Any error information is logged.	(0000,0901) (0000,0902)
	Cxxx	Error: Unable to process	The association is closed or aborted. Any error information is logged.	(0000,0901) (0000,0902)
Success	0000	Matching is complete - No final identifier is supplied	The SCP has completed the matches. The association is closed and the returned information is retained and displayed on the user interface.	None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	The returned information is retained and displayed on the user interface.	Identifier
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	The returned information is retained and displayed on the user interface.	Identifier

4.2.4 Modality Worklist Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	No worklist information shows on the user interface. Any error information is logged.
Association A-REJECTEd by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	

4.2.5 Worklist attribute usage

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

Below table provides a description of the system Worklist Request Identifier and specifies the attributes that are copied into any acquired images. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made to filter out possible duplicate entries.

Module Name Attribute Name	Tag	VR	M	R	D	IOD
SOP Common						
Specific Character Set	(0008,0005)	CS		X		
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	SQ		X	X	
> Scheduled Station AE Title	(0040,0001)	AE	(S)	X		
> Scheduled Procedure Step Start Date	(0040,0002)	DA	(R)	X	X	
> Scheduled Procedure Step Start Time	(0040,0003)	TM		X	X	
> Modality	(0008,0060)	CS	(S)	X		X
> Scheduled Performing Physician's Name	(0040,0006)	PN		X		
> Scheduled Procedure Step Description	(0040,0007)	LO		X	X	
> Scheduled Station Name	(0040,0010)	SH		X		
> Scheduled Procedure Step Location	(0040,0011)	SH		X		
> Scheduled Protocol Code Sequence	(0040,0008)	SQ		X	X	
> Pre-Medication	(0040,0012)	LO		X		
> Scheduled Procedure Step ID	(0040,0009)	SH		X	X	
> Requested Contrast Agent	(0032,1070)	LO		X		
> All other Attributes from the Scheduled Procedure Step Module				X		
Requested Procedure						
Requested Procedure ID	(0040,1001)	SH		X	X	
Requested Procedure Description	(0032,1060)	LO		X	X	X
Requested Procedure Code Sequence	(0032,1064)	SQ		X	X	
Study Instance UID	(0020,000D)	UI		X		X
Study ID	(0020,0010)	SH		X	X	
Referenced Study Sequence	(0008,1110)	SQ		X		
Requested Procedure Priority	(0040,1003)	SH		X		
Patient Transport Arrangements	(0040,1004)	LO		X		
All other Attributes from the Requested Procedure Module				X		
Imaging Service Request						
Accession Number	(0008,0050)	SH		X	X	X
Requesting Physician	(0032,1032)	PN		X		
Referring Physician's Name	(0008,0090)	PN		X	X	X
All other Attributes from the Imaging Service Request Module				X		
Visit Identification						
Admission ID	(0038,0010)	LO		X		
Issuer Of Admission ID	(0038,0011)	LO		X		
All other Attributes from the Visit Identification Module				X		

Module Name Attribute Name	Tag	VR	M	R	D	IOD
Visit Status Current Patient Location All other Attributes from the Visit Status Module	(0038,0300)	LO		X X		
Visit Admission Admitting Diagnosis Description All other Attributes from the Visit Admission Module	(0008,1080)	LO		X X		
Patient Identification Patient Name Patient ID All other Attributes from the Patient Identification Module	(0010,0010) (0010,0020)	PN LO		X X X	X X	X X
Patient Demographic Patient's Birth Date Patient's Sex Patient's Weight Patient's Size Confidentiality constraint on patient data All other Attributes from the Patient Demographic Module	(0010,0030) (0010,0040) (0010,1030) (0010,1020) (0040,3001)	DA CS DS DS LO		X X X X X	X	X X
Patient Medical Patient State Pregnancy Status Medical Alerts Contrast Allergies Special Needs All other Attributes from the Patient Medical Module	(0038,0500) (0010,21C0) (0010,2000) (0010,2110) (0038,0050)	LO US LO LO LO		X X X X X X		

The above table should be read as follows:

Module Name: The name of the associated module for supported worklist attributes.

Attribute Name: Attributes supported to build a Scan Station AE worklist Request Identifier.

Tag: DICOM tag for this attribute.

VR: DICOM VR for this attribute.

M: Matching keys for Worklist Update. An "S" indicates that the system may supply an attribute value for Single Value Matching, an "R" indicates Range Matching and a "*" denotes wildcard matching. The system can also be configured, "(S)" or "(R)", to supply a matching value.

R: Return keys. An "X" indicates that this system supplies this attribute as a Return Key with zero length for Universal Matching.

D: Displayed keys. An “X” indicates that this worklist attribute is displayed to the user on the Scan Station in the Worklist Screen.

IOD: An “X” indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step.

The default query configuration sets “Modality” to “US” and “Scheduled Procedure Step Start Date” to “Current Week”. Both items can be configured to other settings.

5. MODALITY PERFORMED PROCEDURE STEP IMPLEMENTATION

5.1 INTRODUCTION

This section specifies the use of the DICOM Modality Performed Procedure Step information to be communicated to the Hospital/Radiology information system.

This feature works in conjunction with DICOM Modality Worklist feature, if installed. However the conformance of this feature is independent of Modality Worklist feature. For information on conformance of Modality Worklist feature to DICOM standard please refer to the appropriate section in this document.

5.2 REAL-WORLD ACTIVITY START EXAM/END EXAM

5.2.1 Description and Sequencing of Activity

An association is established when one of the actions shown below occurs.

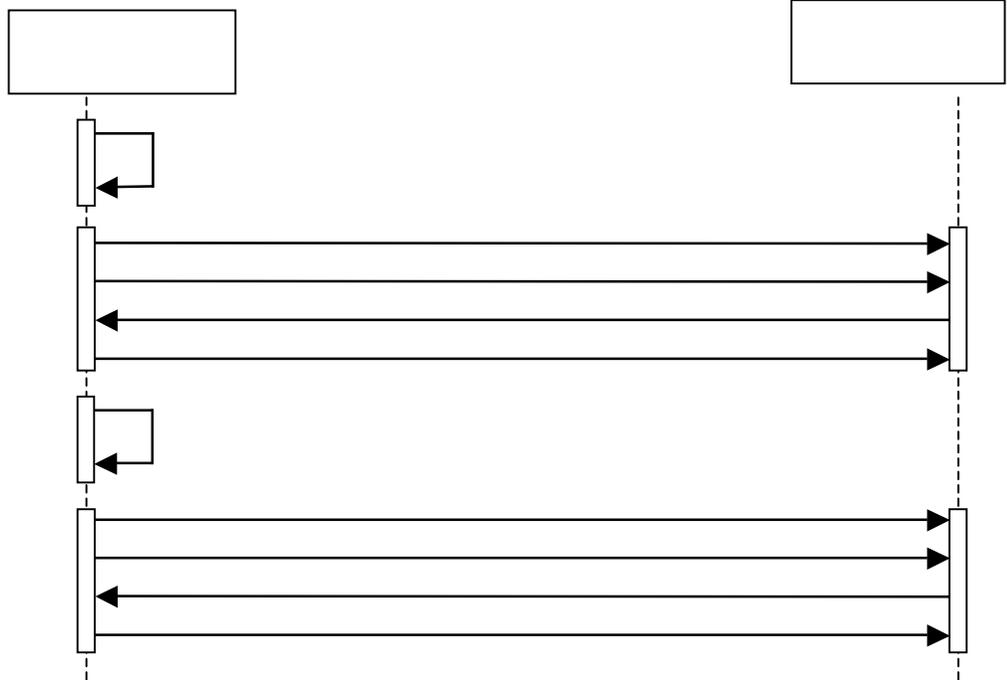
- Pressing Start Exam button.
- Selecting Next Patient in the Worklist screen.
- Selecting Log out button in the screen.

In each case a new association is opened an identifier for the N-Create request will be created and sent or the identifier from the N-Create request will be sent for the N-Set request. The Scan Station AE then waits for responses. On receiving the response or an error condition the association is closed.

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- 2. Open Association
- 3. N-Create Request
- 4. N-Create Response
- 5. Close Association
- 6. End Exam
- 7. Open Association
- 8. N-Set Request
- 9. N-Set Response
- 10. Close Association



5.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE Scan Station AE for Activity Start Exam/End Exam					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

5.2.3 SOP Specific DICOM Conformance Statement for Modality Performed Procedure Step SOP Class N-Create

Module Name		Tag	Value	Presence of Value	Source
Attribute Name					
SOP Common					
	Specific Character Set	(0008,0005)		ABSENT	
Performed Procedure Step Relationship					
	Scheduled Procedure Step Sequence	(0040,0100)		ALWAYS	AUTO
	>Study Instance UID	(0020,000D)		ALWAYS	MWL AUTO
	>Referenced Study Sequence	(0008,1110)		EMPTY	AUTO
	>>Referenced SOP Class UID	(0008,1150)		ABSENT	
	>>Referenced SOP Instance UID	(0008,1155)		ABSENT	
	>Accession Number	(0008,0050)		VNAP	MWL
	>Placer Order Number/Imaging Service Request	(0040, 2016)		ABSENT	

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Module Name		Tag	Value	Presence of Value	Source
Attribute Name					
	>Filler Order Number/Imaging Service Request	(0040, 2017)		ABSENT	
	>Request Procedure ID	(0040,1001)		VNAP	MWL
	>Request Procedure Description	(0032,1060)		VNAP	MWL
	>Scheduled Procedure Step ID	(0040,0009)		VNAP	MWL
	>Scheduled Procedure Step Description	(0040,0007)		VNAP	MWL
	>Scheduled Protocol Code Sequence	(0040,0008)		VNAP	MWL
	>>Code Value	(0008,0100)		ANAP	MWL
	>>Coding Scheme Designator	(0008,0102)		ANAP	MWL
	>>Code Scheme Version	(0008,0103)		ANAP	MWL
	>>Code Meaning	(0008,0104)		ANAP	MWL
	Patient's Name	(0010,0010)		VNAP	MWL
	Patient ID	(0010,0020)		VNAP	MWL
	Patients Birth Date	(0010,0030)		VNAP	MWL
	Patient's Sex	(0010,0040)		VNAP	MWL
	Referenced Patient Sequence	(0008,1120)		EMPTY	AUTO
	>Referenced SOP Class UID	(0008,1150)		ABSENT	
	>Referenced SOP Instance UID	(0008,1155)		ABSENT	
	Admission ID	(0038,0010)		VNAP	MWL
	Issuer of Admission ID	(0038,0011)		VNAP	MWL
Performed Procedure Step Relationship					
	Performed Procedure Step ID	(0040,0253)		ALWAYS	MWL
	Performed Station AE Title	(0040,0241)		ALWAYS	CONFIG
	Performed Station Name	(0040,0242)		EMPTY	AUTO
	Performed Location	(0040,0243)		EMPTY	AUTO
	Performed Procedure Step Start Date	(0040,0244)		ALWAYS	AUTO
	Performed Procedure Step Start Time	(0040,0245)		ALWAYS	AUTO
	Performed Procedure Step Status	(0040,0252)	IN PROGRESS	ALWAYS	AUTO
	Performed Procedure Step Description	(0040,0254)		VNAP	MWL
	Performed Procedure Step End Date	(0040,0250)		EMPTY	AUTO
	Performed Procedure Step End Time	(0040,0251)		EMPTY	AUTO
	All other attributes in Performed Procedure Step Information			EMPTY	AUTO

Module Name		Tag	Value	Presence of Value	Source
Attribute Name					
Image Acquisition Results					
	Modality	(0008,0060)	US	ALWAYS	AUTO
	All other attributes in Image Acquisition Results			EMPTY	AUTO

5.2.4 Modality Performed Procedure Step Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The association is closed.

5.2.5 MPPS N-Create Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	The MPPS N-Create request aborts and error information is logged.
Association A-REJECTed by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	

5.2.6 SOP Specific Conformance to Modality Performed Procedure Step SOP Class N-Set

Module Name		Tag	Value	Presence of Value	Source
Attribute Name					
Performed Procedure Step Information					
	Performed Procedure Step Status	(0040,0252)	COMPLETED	ALWAYS	AUTO
	Performed Procedure Step Description	(0040,0254)		EMPTY	AUTO
	Performed Procedure Step End Date	(0040,0250)		ALWAYS	AUTO
	Performed Procedure Step End Time	(0040,0251)		ALWAYS	AUTO
	All other attributes in Performed Procedure Step Information			EMPTY	AUTO
Image Acquisition Results					
	Performed Series Sequence	(0040,0340)		ALWAYS	AUTO
	>Performing Physician's Name	(0008,1050)		EMPTY	AUTO
	>Protocol Name	(0018,1030)	Single Image	ALWAYS	AUTO
	>Operator's Name	(0008,1070)		EMPTY	AUTO
	>Series Instance UID	(0020,000E)		ALWAYS	AUTO
	>Series Description	(0008,103E)		EMPTY	AUTO
	>Retrieve AE Title	(0008,0054)		EMPTY	AUTO
	>Referenced Image Sequence	(0008,1140)		EMPTY	AUTO
	>>Referenced SOP Class UID	(0008,1150)		ABSENT	
	>>Referenced SOP Instance UID	(0008,1155)		ABSENT	
	>Referenced Standalone SOP Instance Sequence	(0040,0220)		EMPTY	AUTO

Module Name	Tag	Value	Presence of Value	Source
Attribute Name				
All other attributes in Image Acquisition Results			EMPTY	AUTO

5.2.7 Modality Performed Procedure Step Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The association is closed.

5.2.8 MPPS N-Set Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	The MPPS N-Set request aborts and error information is logged.
Association A-REJECTEd by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	