Technical Publications

Direction DOC1806201
Revision 01

Invenia ABUS Review Software 2.x.x
DICOM CONFORMANCE STATEMENT

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GE Healthcare

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CONFORMANCE STATEMENT OVERVIEW

Invenia ABUS Review Software supports receiving DICOM Ultrasound, Multi-frame Ultrasound, and 3D Ultrasound images. It is also able to query and retrieve images from external systems, and to send and print images to external systems.

Table 0.1 provides an overview of the network services supported by Invenia ABUS Review Software.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Ultrasound Multi-frame Image Storage	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Encapsulated PDF Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Grayscale Softcopy Presentation State Storage	Yes	Yes
Basic Text SR	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No
Print Management		
Basic Grayscale Print Management Meta SOP Class	Yes	No
Basic Color Print Management Meta SOP Class	Yes	No

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1. INTRODUCTION

1.1 OVERVIEW

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

This DICOM Conformance Statement is written according to part PS 3.2 of the DICOM standard.

The application described in this conformance statement is the Invenia ABUS Review Software. The ABUS Review Software acts as SCU and SCP for the DICOM Storage and as SCU for DICOM Query/Retrieve and Print.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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

GEHC DICOM Conformance Statements

$@$

http://www.ge.com/DICOM

APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

Product Implementation:

CT Advantage

MR Advantage

Invenia ABUS
Workstatrion
Conformance
Statement
Direction:
<number>

......
Conformance
Statement
Direction:
......

DICOM STANDARD

Standard Specification:

DICOM

Part 1

DICOM 2

DICOM 3

DICOM 4

DICOM

Part 16

This document specifies the DICOM implementation. It is entitled:

> *Invenia ABUS Review Software 2.x.x*
> *Conformance Statement for DICOM*
> *Direction DOC1806201*

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

DICOM by itself does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with the ABUS Review Software and other vendors' of DICOM equipment. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

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 workstation.

- **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 definitons 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

ABUS   Automated Breast Ultrasound System

AE   Application Entity

ANSI   American National Standards Institute

DICOM   Digital Imaging and Communications in Medicine

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

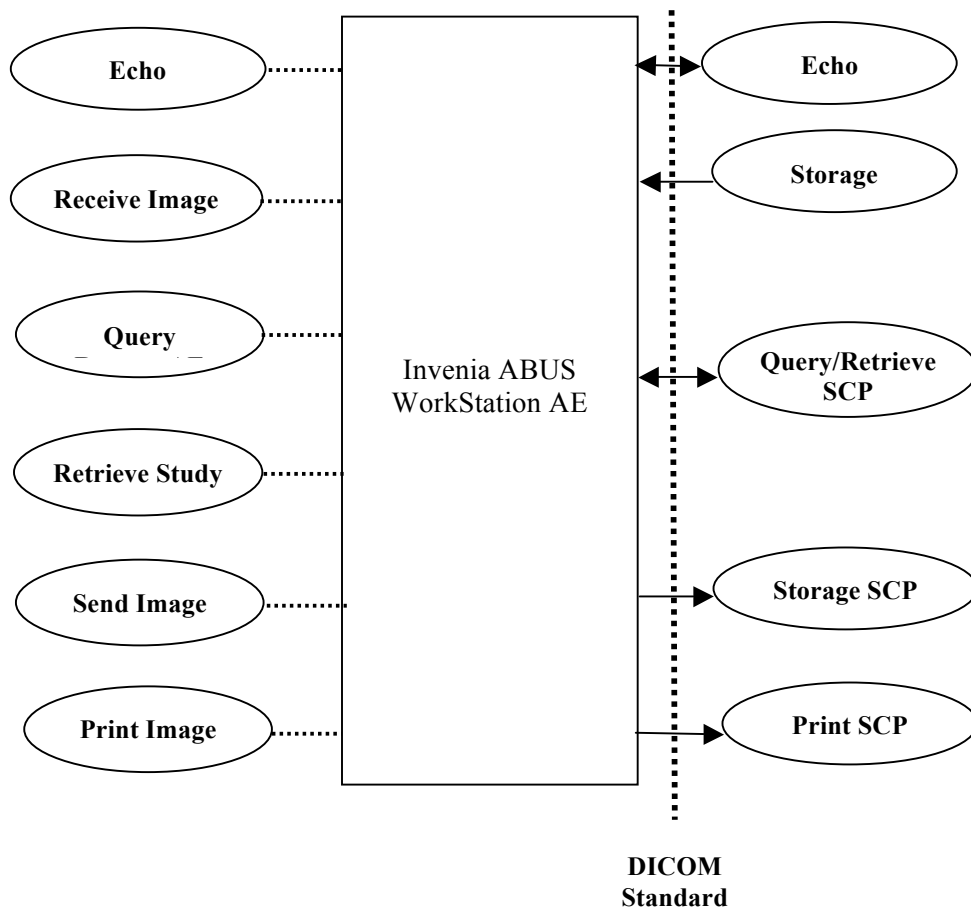# 2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Invenia ABUS Review Software compliance to DICOM requirements for Networking features.

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

The network application model for the Invenia ABUS Review Software is shown in the following Illustration :

ILLUSTRATION 2–1
INVENIA ABUS REVIEW SOFTWARE NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM

```
  ┌─────────┐                    ┌──────────────┐    ┌─────────┐
  │  Echo   │···········         │              │◄──►│  Echo   │
  └─────────┘                    │              │    └─────────┘
                                 │              │
  ┌─────────────┐                │              │    ┌─────────┐
  │Receive Image│···········     │              │◄───│ Storage │
  └─────────────┘                │              │    └─────────┘
                                 │              │
  ┌─────────┐                    │ Invenia ABUS │    ┌──────────────┐
  │  Query  │···········         │ WorkStation  │◄──►│Query/Retrieve│
  └─────────┘                    │     AE       │    │     SCP      │
                                 │              │    └──────────────┘
  ┌──────────────┐               │              │
  │Retrieve Study│···········    │              │
  └──────────────┘               │              │    ┌─────────────┐
                                 │              │───►│ Storage SCP │
  ┌────────────┐                 │              │    └─────────────┘
  │ Send Image │···········      │              │
  └────────────┘                 │              │    ┌───────────┐
                                 │              │───►│ Print SCP │
  ┌─────────────┐                │              │    └───────────┘
  │ Print Image │············    │              │
  └─────────────┘                └──────────────┘
                                       DICOM
                                     Standard
```

2.2.2 Functional Definition of AE's

The ABUS Review Software has a single AE that performs all the required DICOM related tasks.

The AE responds to storage request and verification request.

The AE initiates a DICOM Association to send images.

The AE initiates a DICOM Association to perform query and receives patient and study information.

The AE initiates a DICOM Association to retrieve images.

The AE Initiates a DICOM Association to send images to a DICOM Print SCP.

The AE Initiates a DICOM Association to verify connection.

2.2.3 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background and not dependent on any sequencing. All SCU activities are sequentially initiated in the user interface but run asynchronously.

2.3 AE SPECIFICATIONS

2.3.1 ABUS Review Software AE Specification

The ABUS Review Software 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
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Yes	No
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Yes	No
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Yes	Yes
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Yes	Yes
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Yes	Yes

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 ABUS Review Software is:

Maximum Length PDU	16 KB

It is not configurable

2.3.1.1.2 Number of Associations

The ABUS Review Software AE accepts multiple associations at a time. The maximum number is 10. If the number is reached, a newly required association will be rejected until some associations are released. This transient rejection response might be delayed to avoid immediate retries.

The Storage SCU initiates a new association for each request, but there is only one open association at a time. The Query/Retrieve SCU initiates a new association for request. The Print SCU initiates a new association for each request, but there is only one open association at a time

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:

ABUS Review Software **Implementation UID**	2.16.840.1.114241.1
ABUS Review Software **Implementation Version Name**	U-SYSTEMS_V1.0

2.3.1.2 Association Initiation Policy

The AE will attempt to establish a new association with a remote device due to five real world activities:

Send Image initiates by the user for storing images and encapsulated pdf, Query Remote AE initiates by the user for receiving patient and study information, Retrieve Study initiates by the user for retrieving images, Print Image initiates by the user for print images to DICOM Print SCP, and Echo verifies the communication between peer DICOM AEs. Each time one of these activities is initiated an identical sequence of actions will occur as described in the sections below.

When the ABUS Review Software 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 ABUS Review Software 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 Image

2.3.1.2.1.1 Associated Real-World Activity

Upon the send request, the ABUS Review Software will initiate an association, send one or several Ultrasound, Ultrasound Multi-frame or Secondary Capture images and

encapsulated pdf on that association to the destination. There is only one open association at a time. All export requests are kept in a queue for sequentially transfer. Any failed request can be manually re-sent or deleted.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE ABUS Review Software for Activity Send Image					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian JPEG Baseline	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2 1.2.840.10008.1.2.50	SCU	None
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

2.3.1.2.1.2.1 SOP Specific Conformance to Storage SCU

The secondary captured images created by the ABUS Review Software conform to the DICOM IOD definitions.

2.3.1.2.2 Real-World Activity Retrieve Study

2.3.1.2.2.1 Associated Real-World Activity

Upon the retrieve request, the ABUS Review Software opens a new, dedicated association, issues a C-Move request with the query parameters. After the C-Move request has been completed, the association is closed. The retrieved images are displayed.

2.3.1.2.2.2 Proposed Presentation Context Table

The Move SCU provides Standard Conformance to the following SOP Classes:

Presentation Context Table – Proposed by AE ABUS Review Software for Activity Retrieve Study					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name List	UID List		Negotiation
Study Root Query/Retrieve – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2		

2.3.1.2.2.2.1 SOP Specific Conformance to Move SCU

Only a single information model, Study Root, is supported.

A retrieval will be performed at the STUDY level. No CANCEL requests are ever issued.

The instances are retrieved to the current application's local database by specifying the destination as the AE Title of the ABUS Review Software. This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the ABUS Review Software. The ABUS Review Software receiving application will accept storage requests addressed to it from anywhere, so no pre-configuration of the local application to accept from the remote AE is necessary.

Study Root Request Identifier for Move SCU

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common Specific Character Set	0008, 0005	CS	
Study Level Study Instance UID	0020, 000D	UI	UNIQUE

C-Move SCU Status

Service Status	Meaning	Protocol Code	Behavior
Success	Retrieve has completed – No failures or Warnings.	0000	Association is closed. The retrieve results (images) are displayed.
Pending	Sub-operations are continuing	FF00	The retrieve are continuing.
Failure	Out of Resources	A701, A702	The retrieve has failed. Association is closed. Any error information is logged.
	SOP Class not supported	A800	
	Move Destination Unknown	A801	
	Data Set does not match SOP Class	A900	
	Unable to Process	C000	

2.3.1.2.2.2.2 SOP Specific Conformance for the Basic Grayscale Image Box SOP Class

The ABUS Review Software supports the following DIMSE operations for the Basic Grayscale Image Box SOP Class:

- N-SET

Details of the supported attributes and status handling behavior are described in the following subsection

2.3.1.2.2.2.3 Grayscale Image Box SOP Class Operations (N-SET)

Grayscale Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)		The position of the image on the film, based on Image Display Format (2010,0010).	ALWAYS	AUTO
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
>Rows	(0028,0010)	US	Image dependant	ALWAYS	AUTO
>Columns	(0028,0011)	US	Image dependant	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	IS	Only sent if none 1:1 aspect ratio	ANAP	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixel data of print image	ALWAYS	AUTO

The behavior of the ABUS Review Software when encountering status codes in an N-SET response is summarized in the below Table.

Grayscale Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image successfully stored in Image Box	0000	Print operation will continue.
Warning	Image size larger than image box size, the image has been de-magnified.	B604	Association is closed. The print image is discarded. Information is logged.
	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605	
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609	

Service Status	Further Meaning	Error Code	Behavior
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A	
Failure	Image size is larger than image box size	C603	
	Insufficient memory in printer to store the image	C605	
	Combined Print Image size is larger than the Image Box size	C613	
*	*	Any other code	

2.3.1.2.2.2.4 SOP Specific Conformance for the Basic Color Image Box SOP Class

The ABUS Review Software supports the following DIMSE operations for the Basic Color Image Box SOP Class:

- N-SET

Details of the supported attributes and status handling behavior are described in the following subsection.

2.3.1.2.2.2.5 Color Image Box SOP Class Operations (N-SET)

The attributes supplied in an N-SET request are listed in the below table.

Color Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)		The position of the image on the film, based on Image Display Format (2010,0010).	ALWAYS	AUTO
Basic Color Image Sequence	(2020,0111)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	AUTO
>Planar Configuration	(0028,0006)	US	1	ALWAYS	AUTO
>Rows	(0028,0010)	US	Image dependant	ALWAYS	AUTO
>Columns	(0028,0011)	US	Image dependant	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	IS	Only sent if none 1:1 aspect ratio	ANAP	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixel data of print image	ALWAYS	AUTO

The behavior of the ABUS Review Software when encountering status codes in an N-SET response is summarized in the below Table.

Color Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image successfully stored in Image Box	0000	Print operation will continue.
Warning	Image size larger than image box size, the image has been de-magnified.	B604	Association is closed. The print image is discarded. Information is logged.
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609	
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A	
Failure	Image size is larger than image box size	C603	
	Insufficient memory in printer to store the image	C605	
	Combined Print Image size is larger than the Image Box size	C613	
*	*	Any other code	

2.3.1.2.3 Real-World Activity Echo Request

2.3.1.2.3.1 Associated Real-World Activity

Upon the search request, the ABUS Review Software opens a new dedicated association, issues a C-Find request with the query parameters. "Pending Responses" are propagated back to the initiator. After the C-Find request has been completed, the association is closed.

2.3.1.2.3.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE ABUS Review Software for Activity Echo Request					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
		Explicit VR Big Endian	1.2.840.10008.1.2		

2.3.1.2.3.3 SOP Specific Conformance to Echo SCU

The behavior of the ABUS Review Software AE when it receives status codes in a Verification C-ECHO response is summarized in below table. If any SCP response status other than "Success" is received by the system, a message shows Echo failed.

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Verification C-ECHO Response Status Handling Behavior

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

The behavior of the ABUS Review Software AE during communication failure is summarized in the below Table.

Verification Communications Failure Behavior

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	A message shows Echo failed. 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).	

2.3.1.3 Association Acceptance Policy

The ABUS Review Software application attempts to accept a new association for

- DIMSE C-ECHO

- DIMSE C-STORE

Generally associations are accepted if all of the following conditions are true:

- The maximum number of incoming associations is not reached

- At least one Presentation Context has been proposed with at least one of the following transfer syntax:

    o Explicit VR Little Endian

    o Explicit VR Big Endian

    o Implicit VR Little Endian

    o JPEG Baseline

2.3.1.3.1 Real-World Activity Receive Image

2.3.1.3.1.1 Accepted Presentation Context Table

The Storage SCP provides Standard Conformance to the following SOP Classes:

Presentation Context Table - Accepted by AE ABUS Review Software for Activity Receive Image					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		

Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.1		
		Implicit VR Little Endian	1.2.840.10008.1.2.2		
		JPEG Baseline	1.2.840.10008.1.2.50		
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	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Baseline	1.2.840.10008.1.2.50		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		JPEG Baseline	1.2.840.10008.1.2.50		
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

2.3.1.3.1.1.1 SOP Specific Conformance to Storage SCP

In case of a successful C-Store operation, the image has successfully been written on disk either in Explicit Little Endian format or in the JPEG Baseline format received. Table lists the status codes returned for the C-Store operation.

C-Store SCP Return Status

Service Status	Meaning	Protocol Code	Behavior
Success	Image is successfully stored on file system	0000	The image transfer has completed. The association is closed. The successful image transfer does not guarantee the successful storage of metadata in the database.
Failure	Out of Resources	A700	The image transfer has failed. Association is closed. Any error information is logged.
	Data Set does not match SOP Class	A900	
	Can not understand	C000	

2.3.1.3.2 Real-World Activity Receive Echo Request

2.3.1.3.2.1 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE ABUS Review Software for Activity Receive Echo Request					
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	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

2.3.1.3.2.2 SOP Specific Conformance to Echo SCP

The AE provides standard conformance to the Verification Service Class as an SCP.

2.3.1.3.2.3 Presentation Context Acceptance Criterion

No criterion.

2.3.1.3.2.4 Transfer Syntax Selection Policies

Within each Presentation Context, the ABUS Review Software will accept the first proposed transfer syntax that it also supports for that Abstract Syntax.

Within each Presentation Context, the ABUS Review Software will select Transfer Syntaxes according to the following priority (highest priority first):

Explicit VR Little Endian
Explicit VR Big Endian
Implicit VR Little Endian

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
Ethernet 10baseT

The ABUS Review Software only supports IPv4 connections.

2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

Not applicable.

2.5.2 Private Transfer Syntaxes

Not applicable.

2.6 CONFIGURATION

2.6.1 AE Title/Presentation Address Mapping

The AE Title must be unique. On the ABUS Review Software the AE Title to Presentation Address mapping is done by mapping the AE Title to the IP address configured in the Application Entity screen that is accessible to the user.

2.6.2 Configurable Parameters

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

- Local AE Title
- Local Listening Port Number

The following fields are configurable for every remote DICOM AE:

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

Configuration Parameters

Parameter	User Configurable (Yes/No)	Service Configurable (Yes/No)	Default Value
Maximum PDU receive size	No	No	16kB
Maximum PDU send size	No	No	16kB (smaller sizes are negotiated per association)
Timeout for accepting/rejecting an association request	No	Yes	30s
Timeout for responding association open/close request	No	Yes	30s
Timeout for accepting message over network	No	No	120s
Timeout for waiting for data between TCP/IP packets	No	No	120s
Timeout for requesting an association	No	Yes	30s
Timeout for waiting for sending message to a remote node (Storage SCU)	No	No	Unlimited
Timeout for waiting for a service response message from a remote node (Query/Retrieve SCU)	No	No	Unlimited
Timeout waiting for a response to a N-CREATE-RQ, N-SET-RQ or N-ACTION-RQ	No	No	20s

2.7 SUPPORT OF EXTENDED CHARACTER SETS

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

2.8 CODES AND CONTROLLED TERMINOLOGY

2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the product.
- Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
- Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3. PRINT MANAGEMENT IMPLEMENTATION

3.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the implementation for the specific SOP Classes supported in the Basic Grayscale and Color Print Management Meta SOP Classes, the attributes supported for both IODs and services, and the valid range of values for mandatory and optional attributes.

3.2 BASIC FILM SESSION SOP CLASS

The ABUS Review Software supports the following DIMSE operations for the Basic Film Session SOP Class:

- N-CREATE

- N-DELETE

Details of the supported attributes and status handling behavior are described in the following subsections.

3.2.1 Basic Film Session N-Create Attributes

This table lists the attributes that are sent in the Basic Film Session N-Create Request:

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Copies	(2000,0010)	IS	Value from 1 to 10	ALWAYS	CONFIG
Print Priority	(2000,0020)	CS	LOW, MED or HIGH	ALWAYS	CONFIG
Medium Type	(2000,0030)	CS	PAPER, CLEAR FILM or BLUE FILM	ALWAYS	CONFIG
Film Destination	(2000,0040)	CS	PROCESSOR or MAGAZINE	ALWAYS	CONFIG

The behavior of Hardcopy AE when encountering status codes in an N-CREATE response is summarized in the below Table.

Film Session SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film session successfully created	0000	Print operation will continue.
Warning	Memory allocation not supported	B600	Association is closed. The print image is discarded. Information is logged.
*	*	Any other code	

3.2.2 Basic Film Session N-Delete

The behavior of the ABUS Review Software when encountering status codes in a N-DELETE response is summarized in the below Table,

Film Session SOP Class N-DELETE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Successfully operation	0000	Print operation will continue.
*	*	Any other code	Association is closed. The print image is discarded. Information is logged.

3.3 BASIC FILM BOX SOP CLASS

The ABUS Review Software supports the following DIMSE operations for the Basic Film Box SOP Class:

- N-CREATE

- N-ACTION

Details of the supported attributes and status handling behavior are described in the following subsections.

3.3.1 Basic Film Box N-Create Attributes

The attributes supplied in an N-CREATE request are listed in the below Table. None of the settings are configurable.

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Display Format	(2010,0010)	ST	STANDARD\1,1	ALWAYS	AUTO
Film Orientation	(2010,0040)	CS	PORTRAIT	ALWAYS	AUTO
Film Size ID	(2010,0050)	CS	8INX10IN	ALWAYS	AUTO
Magnification Type	(2010,0060)	CS	CUBIC	ALWAYS	AUTO
Smoothing Type	(2010,0080)	CS	<empty>	EMPTY	AUTO
Border Density	(2010,0100)	CS	BLACK	ALWAYS	AUTO
Empty Image Density	(2010,0110)	CS	BLACK	ALWAYS	AUTO
Min Density	(2010,0120)	US	0	ALWAYS	AUTO
Max Density	(2010,0130)	US	300	ALWAYS	AUTO
Trim	(2010,0140)	CS	NO	ALWAYS	AUTO
Configuration Information	(2010,0150)	ST		ABSENT	N/A
Referenced Film Session Sequence	(2010,0500)	SQ		ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	Provided by SCP (printer)	ALWAYS	AUTO

The behavior of the ABUS Review Software when encountering status codes in an N-CREATE response is summarized in the below Table.

Film Box SOP Class N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film session successfully created	0000	Print operation will continue.
Warning	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605	Association is closed. The print image is discarded. Information is logged.
Failure	There is an existing Film Box that has not been printed and N-ACTION at the Film Session level is not supported. A new Film Box will not be created when a previous Film Box has not been printed.	C616	
*	*	Any other code	

3.3.2 Basic Film Box N-Action Attributes

An N-ACTION request is issued to instruct the Print SCP to print the contents of the Film Box. The Action Reply argument in an N-ACTION response is not evaluated.

The behavior of the ABUS Review Software when encountering status codes in an N-ACTION response is summarized in the below Table

Film Box SOP Class N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film accepted for printing	0000	Print operation will continue.
Warning	Film Box SOP Instance hierarchy does not contain Image Box SOP Instances (empty page)	B603	Association is closed. The print image is discarded. Information is logged.
	Image size is larger than image box size, the image has been de-magnified.	B604	
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609	
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A	
Failure	Unable to create Print Job SOP Instance. Print queue is full	C602	
	Image size is larger than image box size	C603	
	Combined Print Image size is larger than the Image Box size	C613	
*	*	Any other code	

3.4 BASIC GRAYSCALE AND COLOR IMAGE BOX SOP CLASSES

3.4.1 Basic Grayscale Image Box SOP Class

The ABUS Review Software supports the following DIMSE operations for the Basic Grayscale Image Box SOP Class:

- N-SET

Details of the supported attributes and status handling behavior are described in the following subsection

Grayscale Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)		The position of the image on the film, based on Image Display Format (2010,0010).	ALWAYS	AUTO
Basic Grayscale Image Sequence	(2020,0110)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
>Rows	(0028,0010)	US	Image dependant	ALWAYS	AUTO
>Columns	(0028,0011)	US	Image dependant	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	IS	Only sent if none 1:1 aspect ratio	ANAP	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixel data of print image	ALWAYS	AUTO

The behavior of the ABUS Review Software when encountering status codes in an N-SET response is summarized in the below Table.

Grayscale Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image successfully stored in Image Box	0000	Print operation will continue.
Warning	Image size larger than image box size, the image has been de-magnified.	B604	Association is closed. The print image is discarded. Information is logged.
	Requested Min Density or Max Density outside of printer's operating range. The printer will use its respective minimum or maximum density value instead.	B605	
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609	
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A	

Service Status	Further Meaning	Error Code	Behavior
Failure	Image size is larger than image box size	C603	
	Insufficient memory in printer to store the image	C605	
	Combined Print Image size is larger than the Image Box size	C613	
*	*	Any other code	

3.4.2 Basic Color Image Box SOP Class

The ABUS Review Software supports the following DIMSE operations for the Basic Color Image Box SOP Class:

- N-SET

Details of the supported attributes and status handling behavior are described in the following subsection:

Color Image Box SOP Class N-SET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Image Position	(2020,0010)		The position of the image on the film, based on Image Display Format (2010,0010).	ALWAYS	AUTO
Basic Color Image Sequence	(2020,0111)	SQ		ALWAYS	AUTO
>Samples Per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	RGB	ALWAYS	AUTO
>Planar Configuration	(0028,0006)	US	1	ALWAYS	AUTO
>Rows	(0028,0010)	US	Image dependant	ALWAYS	AUTO
>Columns	(0028,0011)	US	Image dependant	ALWAYS	AUTO
>Pixel Aspect Ratio	(0028,0034)	IS	Only sent if none 1:1 aspect ratio	ANAP	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7FE0,0010)	OB	Pixel data of print image	ALWAYS	AUTO

The behavior of the ABUS Review Software when encountering status codes in an N-SET response is summarized in the below Table.

Color Image Box SOP Class N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image successfully stored in Image Box	0000	Print operation will continue.
Warning	Image size larger than image box size, the image has been de-magnified.	B604	Association is closed. The print image is discarded. Information is logged.
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609	
	Image size or Combined Print Image size is larger than the Image Box size. Image or Combined Print Image has been decimated to fit.	B60A	
Failure	Image size is larger than image box size	C603	
	Insufficient memory in printer to store the image	C605	
	Combined Print Image size is larger than the Image Box size	C613	
*	*	Any other code	

3.5 PRINTER SOP CLASS

The ABUS Review Software supports the following DIMSE operations and notifications for the Printer SOP Class:

- N-GET

- N-EVENT-REPORT

Details of the supported attributes and status handling behavior are described in the following subsections.

3.5.1 Printer N-GET Attributes

The ABUS Review Software uses the Printer SOP Class N-GET operation to obtain information about the current printer status. The attributes obtained via N-GET are listed in the below table.

Printer SOP Class N-GET Request Attributes

Attribute Name	Tag	VR	Value	Presence of Value	Source
Printer Status	(2110,0010)	CS	Provided by printer	ALWAYS	PRINTER
Printer Status Info	(2110,0020)	CS	Provided by printer	ALWAYS	PRINTER
Printer Name	(2110,0030)	LO	Provided by printer	ALWAYS	PRINTER
Manufacturer	(0008,0070)	LO	Provided by printer	ALWAYS	PRINTER
Manufacturer Model Name	(0008,1090)	LO	Provided by printer	ALWAYS	PRINTER
Device Serial Number	(0018,1000)	LO	Provided by printer	ALWAYS	PRINTER
Software Versions	(0018,1020)	LO	Provided by printer	ALWAYS	PRINTER

Attribute Name	Tag	VR	Value	Presence of Value	Source
Date Of Last Calibration	(0018,1200)	DA	Provided by printer	ALWAYS	PRINTER
Time Of Last Calibration	(0018,1201)	TM	Provided by printer	ALWAYS	PRINTER

If Printer Status (2110,0010) is FAILURE, the print request is discarded. In all cases the returned status information (2110,0010) and (2110,0020) is logged.

The behavior of the ABUS Review Software when encountering status codes in an N-GET response is summarized in the below Table.

Printer SOP Class N-GET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The request to get printer status information was successful. Print operation will continue.
*	*	Any other status code	Association is closed. The print image is discarded. Information is logged.

3.5.2 Printer N- EVENT-REPORT Attributes

The ABUS Review Software is capable of receiving an N-EVENT-REPORT request at any time during an association for printing.

The behavior of the ABUS Review Software when receiving Event Types within the N-EVENT-REPORT is summarized in the below Table.

Printer SOP Class N-EVENT-REPORT Behavior

Event Type Name	Event Type ID	Behavior
Normal	1	Event information is logged and printing will continue. An N-EVENT-REPORT response will be sent with a success status.
Warning	2	
Failure	3	
*	*	

4. QUERY IMPLEMENTATION

4.1 INVENIA ABUS REVIEW SOFTWARE MAPPING OF DICOM ENTITIES

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

TABLE 4-1
MAPPING OF DICOM ENTITIES TO ABUS REVIEW SOFTWARE ENTITIES

DICOM	INVENIA ABUS REVIEW SOFTWARE Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

4.2 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Query/Retrieve Information Model.

4.2.1 Common Query Keys

Upon the search request, the ABUS Review Software opens a new dedicated association, issues a C-Find request with the query parameters. "Pending Responses" are propagated back to the initiator. After the C-Find request has been completed, the association is closed.

Proposed Presentation Context Table

The Find SCU provides Standard Conformance to the following SOP Classes:

Presentation Context Table – Proposed by AE ABUS Review Software for Activity Query Remote AE					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

SOP Specific Conformance to Find SCU

Only a single information model, Study Root, is supported.

All queries are initiated at the highest level of the information model (the STUDY level), and then for each response received, recursively repeated at the next lower levels (the SERIES and then IMAGE levels) if configured. No CANCEL requests are ever issued.

Unexpected attributes returned in a C-FIND response (those not requested) are ignored. Requested return attributes not returned by the SCP are listed as blank values. Non-matching responses returned by the SCP due to unsupported matching keys are not filtered locally by the FIND-SCU and thus will still be presented in the browser. No attempt is made to filter out duplicate responses.

Specific Character Set will always be included at every query level.

Study-Root Request Identifier for Find SCU

Level Name Attribute Name	Tag	VR	Types of Matching
SOP Common Specific Character Set	0008, 0005	CS	
Study Level			
Patient's Name	0010, 0010	PN	S, *, U
Patient ID	0010, 0020	LO	S, *, U
Patient's Birth Date	0010, 0030	DA	NONE
Patient's Sex	0010, 0040	CS	NONE
Issuer of Patient ID	0010,0021	LO	NONE
Other Patient IDs	0010, 1000	CS	NONE
Study Instance UID	0020, 000D	UI	UNIQUE
Study ID	0020, 0010	SH	NONE
Study Date	0008, 0020	DA	S, *, U, R
Study Time	0008, 0030	TM	NONE
Accession Number	0008, 0050	SH	NONE
Study Description	0008, 1030	LO	NONE
Referring Physician's Name	0008, 0090	PN	NONE
Modalities in Study	0008, 0061	CS	S, *, U
Series Level			
Series Instance UID	0020, 000E	UI	UNIQUE
Series Number	0020, 0011	IS	NONE
Modality	0008, 0060	CS	S, *, U
Body Part Examined	0018, 0015	CS	NONE
Laterality	0020, 0060	CS	NONE
Series Description	0008, 103E	LO	NONE
Series Date	0008, 0021	DT	NONE
Series Time	0008, 0031	TM	NONE
Operator's Name	0008, 1070	PN	NONE

Image Level			
SOP Instance UID	0008, 0018	UI	UNIQUE
SOP Class UID	0008, 0016	UI	NONE
Instance Number	0020, 0013	IS	NONE
Content Date	0008, 0023	DA	NONE
Content Time	0008, 0033	TM	NONE
View Name	0008, 2127	SH	NONE

Types of Matching:

An "S" indicates the identifier attribute uses Single Value Matching, an "R" indicates Range Matching, an "*"indicates wildcard matching, and a 'U' indicates Universal Matching. "NONE" indicates that no matching is supported, but that values for this Element are requested to be returned (i.e. universal matching), and "UNIQUE" indicates that this is the Unique Key for that query level, in which case Universal Matching or Single Value Matching is used depending on the query level

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Out of Resources	The query has failed. Association is closed. Any error information is logged.
	A800	SOP Class not supported	
	A900	Data Set does not match SOP Class	
	C000	Unable to Process	
Success	0000	Matching is complete - No final identifier is supplied	
Pending	FF00	Suboperations are continuing	The query is continuing.

5. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

5.1 IOD MODULE TABLE

The Secondary Capture Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes.

SC IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Equipment	SC Equipment	Used	5.2.1.1
Image	General Image	Used	5.2.2.1
	Image Pixel	Used	5.2.2.2
	SC Image	Used	5.2.2.3
	SOP Common	Used	5.2.2.4

5.2 INFORMATION MODULE DEFINITIONS

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

5.2.1 Equipment Entity Modules

5.2.1.1 SC Equipment Module

SC EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Conversion Type	(0008,0064)	1	WSD
Modality	(0008,0060)	3	US

5.2.2 Image Entity Modules

5.2.2.1 General Image Module

GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	AUTO
Patient Orientation	(0020,0020)	2C	BLANK
Content Date	(0008,0023)	2C	AUTO
Content Time	(0008,0033)	2C	AUTO
Acquisition Date	(0008,0022)	3	AUTO
Acquisition Time	(0008,0032)	3	AUTO
Acquisition DateTime	(0008,002A))	3	AUTO
Image Comments	(0020,4000)	3	BLANK
Burned In Annotation	(0028,0301)	3	NO

5.2.2.2 Image Pixel Module

IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	2
Photometric Interpretation	(0028,0004)	1	RGB
Rows	(0028,0010)	1	600
Columns	(0028,0011)	1	600
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	87
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	AUTO
Planar Configuration	(0028,0006)	1C	0

5.2.2.3 SC Image Module

SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Date of Secondary Capture	(0018,1012)	3	AUTO
Time of Secondary Capture	(0018,1014)	3	AUTO

5.2.2.4 SOP Common Module

SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008,0018)	1	AUTO
Specific Character Set	(0008,0005)	1C	

5.3 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended SC SOP Instances as Type 3 data elements.

5.3.1 Standard Attributes

The Product supports the following attributes, not specified in the SC IOD, in SOP Instances as Type 3 data elements.

STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Patient	Patient's Name	0010,0010	<copied from original>
	Patient ID	0010,0020	<copied from original>
	Issuer of Patient ID	0010,0021	<copied from original>
	Patient's Birth Date	0010,0030	<copied from original>
	Patient's Sex	0010,0040	<copied from original>
	Other Patient IDs	0010,1000	<copied from original>
Study	Study ID	0020,0010	<copied from original> if blank 1
	Study Date	0008,0020	<copied from original>
	Study Time	0008,0030	<copied from original>
	Accession Number	0008,0050	<copied from original>
	Referring Physician's Name	0008,0090	<copied from original>
	Study Description	0008,1030	<copied from original>
	Study Instance UID	0020,000D	<copied from original>
Series	Series Date	0008,0021	<copied from original>
	Series Time	0008,0031	<copied from original>
	Series Instance UID	0020,000E	<copied from original>
	Series Number	0020,0011	<copied from original>

ENHANCED DOCUMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
MIME Type of Encapsulated Document	(0042,0012)	1	<NULL>
Encapsulated Document	(0042,0011)	1	<NULL>
Document Title	(0042,0010)	2	<NULL>

6. STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

6.1 IOD MODULE TABLE

The Basic Text, Enhanced, and Comprehensive Structured Report Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes.

STRUCTURE REPORT IOD MODULES

Entity Name	Module Name	Usage	Reference
Series	SR Document Series	Used	6.2.1.1

Equipment	General Equipment	Used	6.2.2.1
Document	SR Document General	Used	6.2.3.1
	SR Document Content	Used	6.2.3.2
	SOP Common	Used	6.2.3.3

6.2 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 SR Information Objects.

6.2.1 Series Entity Modules

6.2.1.1 SR Document Series Module

SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	1	Value = SR
Series Instance UID	(0020,000E)	1	Input Value
Series Number	(0020,0011)	1	Input Value
Series Description	(0008,103E)	3	Invenia ABUS SR with marker and caliper items
Referenced Performed Procedure Step Sequence	(0008,1111)	2	BLANK

6.2.2 Equipment Entity Modules

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6.2.2.1 General Equipment Module

GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	U-SYSTEMS
Manufacturer's Model Name	(0008,1090)	3	

6.2.3 Document Entity Modules

6.2.3.1 SR Document General Module

SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Instance Number	(0020,0013)	1	Input Value
Completion Flag	(0040,A491)	1	PARTIAL = Partial content.
Verification Flag	(0040,A493)	1	UNVERIFIED = Not attested to. Observer Name (0040,A075) who is accountable for its content.
Content Date	(0008,0023)	1	Input Value
Content Time	(0008,0033)	1	Input Value
Performed Procedure Code Sequence	(0040,A372)	2	BLANK

6.2.3.2 SR Document Content Module

SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Value Type	(0040,A040)	1	Input Value
Continuity of Content	(0040,A050)	1C	Input Value
Concept Name Code Sequence	(0040,A043)	1C	Input Value
Content Sequence	(0040,A730)	1C	Input Value
> Relationship Type	(0040,A010)	1	Input Value

6.2.3.2.1 SR Document Content Descriptions

6.2.3.2.1.1 Content Template

The product supports the following root Templates for SR SOP Instances created, processed, or displayed by the product.

SR ROOT TEMPLATES

SOP Class	Template ID	Template Name	Use
Basic Text SR	any		Display
	2000	Basic Diagnostic Imaging Report	Create/Display
Enhanced SR	GEMS-AVA-T01	Advanced Vessel Analysis Report	Create/Display
Comprehensive SR			
Mammo CAD SR	4000	Mammography CAD Document Root	Display
Chest CAD SR	4100	Chest CAD Document Root	Display

6.2.3.3 SOP Common Module

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 Creator UID	(0008,0014)	3	1.2.276.0.7230010.3.0.3.6.1 the same as ImplementationClassUID
Coding Scheme Identification Sequence	(0008,0110)	3	AUTO
>Coding Scheme Designator	(0008,0102)	1	AUTO
>Coding Scheme UID	(0008,010C)	1C	AUTO
>Coding Scheme Name	(0008,0115)	3	AUTO
Instance Number	(0020,0013)	3	AUTO

6.3 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended SR SOP Instances as Type 3 data elements.

6.3.1 Standard Attributes

The Product supports the following attributes, not specified in the SR IODs, in SOP Instances as Type 3 data elements.

STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Patient	PatientName	0010,0010	Input Value
	PatientID	0010,0020	Input Value
	PatientBirthDate	0010,0030	Input Value
	PatientSex	0010,0040	Input Value
	OtherPatientIDs	0010,1000	Input Value
Study	StudyInstanceUID	0020,000d	Input Value
	StudyDescription	0008,1030	Input Value
	ReferencedPerformedProcedureStepSequence	0008,1111	Input Value
	StudyDate	0008,0020	Input Value
	StudyTime	0008,0030	Input Value
	StudyID	0020,0010	Input Value
	AccessionNumber	0008,0050	Input Value
	ReferringPhysicianName	0008,0090	Input Value
Series	SeriesNumber	0020,0011	Input Value
	Modality	0008,0060	Input Value
Document	Value Type	(0040,A040)	Input Value
	Continuity of Content	(0040,A050)	Input Value
	Concept Name Code Sequence	(0040,A043)	Input Value
	Content Sequence	(0040,A730)	Input Value
	Relationship Type	(0040,A010)	Input Value

7. ENCAPSULATED PDF IMPLEMENTATION

7.1 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Encapsulated PDF Information Object.

7.1.1 Equipment Entity Modules

7.1.1.1 General Equipment Module

GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	U-SYSTEMS

Institution Name	(0008,0080)	3	<CONFIG>
Manufacturer's Model Name	(0008,1090)	3	Invenia ABUS WS
Software Versions	(0018,1020)	3	AUTO

7.1.1.2 SC Equipment Module

SC EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Modality	(0008,0060)	3	OT

7.1.2 Image Entity Modules

7.1.2.1 General Image Module

GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	BLANK
Content Date	(0008,0023)	2C	AUTO
Content Time	(0008,0033)	2C	AUTO
Acquisition Date	(0008,0022)	3	AUTO
Acquisition Time	(0008,0032)	3	AUTO
Acquisition DateTime	(0008,002A))	3	AUTO
Burned In Annotation	(0028,0301)	3	YES

7.1.2.2 SOP Common Module

SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.104.1
SOP Instance UID	(0008,0018)	1	AUTO
Instance Creation Date	(0008,0012)	3	AUTO
Instance Creation Time	(0008,0013)	3	AUTO

7.2 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard Attributes defined in the following sections in Standard Extended SC SOP Instances as Type 3 data elements.

7.2.1 Standard Attributes

The Product supports the following attributes, not specified in the SC IOD, in SOP Instances as Type 3 data elements.

STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Patient	Patient's Name	0010,0010	Copied from original
	Patient ID	0010,0020	Copied from original
	Issuer of Patient ID	0010,0021	Copied from original
	Patient's Birth Date	0010,0030	Copied from original
	Patient's Sex	0010,0040	Copied from original
	Other Patient IDs	0010,1000	Copied from original
Study	Study ID	0020,0010	From MWL VNAP

ENHANCED DOCUMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
MIME Type of Encapsulated Document	(0042,0012)	1	application/pdf
Encapsulated Document	(0042,0011)	1	AUTO
Document Title	(0042,0010)	2	SomoViewer pdf report