Technical Publications

Direction DOC2125966
Revision 01

Invenia ABUS Viewer Version 2.5.x
DICOM CONFORMANCE STATEMENT

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CONFORMANCE STATEMENT OVERVIEW

Invenia ABUS Viewer supports receiving DICOM images. It is also able to query and retrieve DICOM images from external systems, and to send images to external systems.

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

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Digital Mammography X-Ray Image Storage – For Presentation	No	Yes
Ultrasound Multi-frame Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Enhanced MR Image Storage	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Secondary Capture Image Storage	No	Yes
Encapsulated PDF Storage	No	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

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1. INTRODUCTION

1.1 OVERVIEW

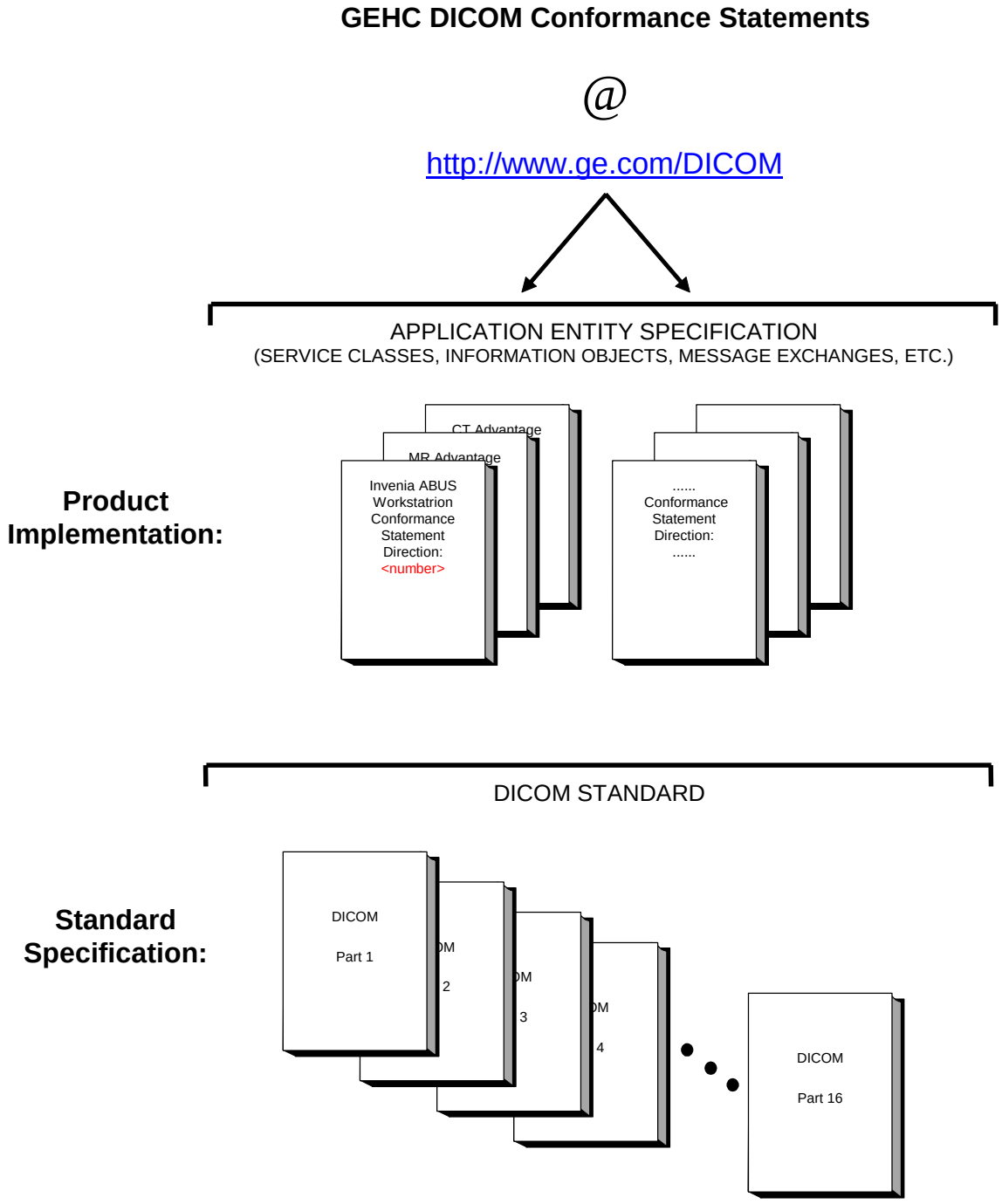
This DICOM Conformance Statement is divided into Sections as described below:

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 Viewer . The Invenia ABUS Viewer acts as SCU and SCP for the DICOM Storage and as SCU for DICOM Query/Retrieve.

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 Viewer 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 Viewer 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/

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,.

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.

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
AET	Application Entity Title
CAD	Computer Aided Detection
ANSI	American National Standards Institute
DICOM	Digital Imaging and Communications in Medicine

GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
LAN	Local Area Network
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
US	Ultrasound
UID	Unique Identifier
VR	Value Representation

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

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

2.2 IMPLEMENTATION MODEL

The Invenia ABUS Viewer is a Networked Medical Imaging viewer application dedicated to Review of ABUS images. The viewer uses DICOM services to import ABUS images

and DICOM content related to the study performed by the Invenia ABUS Scan Station for possible further analysis or processing and to export to other DICOM implementations.

2.2.1 Application Data Flow Diagram

The network application model for the Invenia ABUS Viewer is shown in the following Drawing:

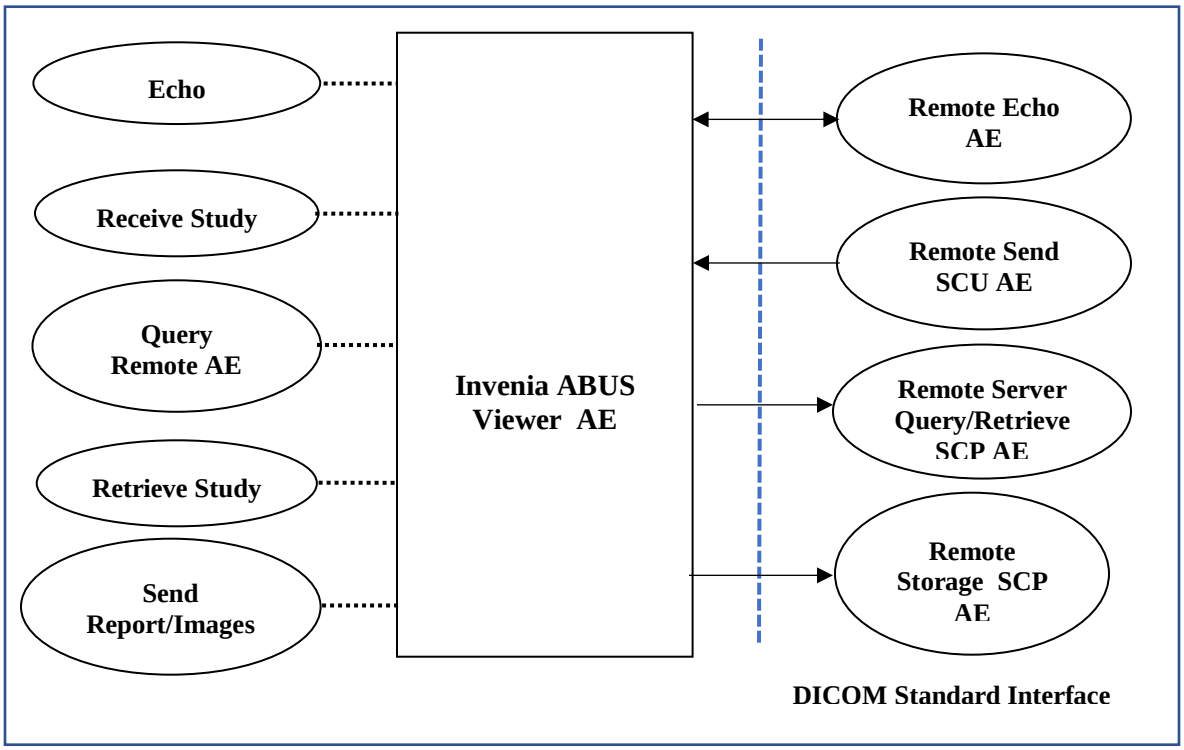


Figure 2–1 Invenia ABUS Viewer Network Application Model and Data Flow Diagram

The Invenia ABUS Viewer Application Entity (AE) is an application that handles DICOM protocol communication. The Invenia ABUS Viewer AE is automatically brought up when the Invenia Invenia ABUS Viewer SW is initialized.

The Invenia ABUS Viewer AE is invoked by the following Real World Activities:

- **Echo**

The Invenia ABUS Viewer AE automatically sends a verification request to a Remote (Echo) AE upon configuration and periodically every 30 seconds thereafter. The success or failure result is indicated on the GUI icon next to the remote destination selection and the configuration entry.

- **Receive Study**

A Remote Send SCU AE sends images to the Invenia ABUS Viewer AE. Received images are installed in the local image database.

Received images are processed for Review. The initial study status is set to NEW. Images received will be installed in the local database. Received images from the Invenia Scan Station are processed prior to Review. Received images may be deleted at anytime.

- **Query Remote**

The user manually initiates remote study queries from the Study Browser with a Remote Query/Retrieve SCP AE to obtain a list of data for a study at the Study/Series level.

- **Retrieve Study**

Once the remote list of data at the study level is displayed (Query Remote) in the Study Browser for a Remote Query/Retrieve SCP AE , the user can retrieve the SOP Classes supported by the Invenia ABUS Viewer.

- **Send Report/Images**

From the Study Browser, a user may manually initate the Export of a DICOM Study in the Local Database.

From the Data Plane, a user may manually initate a data export of selected screen captures and PDF reports as a DICOM C-STORE via the Invenia ABUS Viewer AE to a Remote Storage SCP AE.

The Invenia ABUS Viewer AE may be configured to automatically Send a Signed report with or without associated images to a Remote Storage AE.

2.2.2 Functional Definition of AE's

The Invenia ABUS Viewer has a single AE that performs all the required DICOM related tasks.

The Invenia ABUS Viewer AE responds to storage request and verification request.

The Invenia ABUS Viewer AE initiates a DICOM Association to send images.

The Invenia ABUS Viewer 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 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 Invenia ABUS Viewer AE Specification

The Invenia ABUS Viewer 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
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	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
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 Invenia ABUS Viewer is:

Maximum Length PDU	28672 Bytes Not Configurable

2.3.1.1.2 Number of Associations

The Invenia ABUS Viewer 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.

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:

Implementation UID	2.16.840.1.114241.1
Implementation Version Name	Invenia ABUS 201

2.3.1.2 Association Initiation Policy

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

- **Send Report/Images** 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, 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 Invenia ABUS Viewer 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 Invenia ABUS Viewer 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 Report/Images

2.3.1.2.1.1 Associated Real-World Activity

From the Study Browser, a user may manually initate the Export of a DICOM Study from the Local Database to a Remote Storage SCP AE.

From the Data Plane, a user may manually initate a data export of selected screen captures and PDF reports as a DICOM C-STORE via the Invenia ABUS Viewer AE to a Remote Storage SCP AE.

From the Data Plane, the export status may be reviewed and, if desired, retry a transfer may be initiated.

The Invenia ABUS Viewer AE may be configured to automatically Send a Signed Report with or without the associated images to a Remote Storage AE.

Upon the send request, the Invenia ABUS Viewer will initiate an association, send one or several SOP Instances 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.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Invenia ABUS Viewer for Activity Send Report/Images					
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 Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCU	None
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for All Storage SOP Classes

The Invenia ABUS Viewer includes optional data elements in the SOP Instances as described in Sections

4.0 Secondary Capture Information Object Implementation
5.0 Structured Report Information Object Implementation
6.0 Ecapsulated PDF Implementation
7.0 US MULTI-FRAME Information Object Implementation

Following are the status codes that are more specifically processed when receiving messages from a Storage SCP system:

STATUS CODES RECEIVED BY SCAN STATION AE FOR ACTIVITY *SEND Report/Images*

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700–A7FF	Refused: Out of Resources		(0000,0902)

	A900–A9FF	Error: Data Set does not match SOP Class	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.	(0000,0901) (0000,0902)
	C000-CFFF	Error: 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

2.3.1.2.1.2.2 SOP Specific DICOM Conformance Statement for the Ultrasound Multi-frame Image Storage SOP Class

See Section 2.3.1.2.2.1 “SOP Specific DICOM Conformance Statement for All Storage SOP Classes” for details on general Storage Service SCU processing also applicable to the Ultrasound Multi-frame Image Storage SOP Classes.

The Invenia ABUS Viewer recieving Ultrasound Multiframe Image Storage SOP Class objects, originating from an ABUS Scan Station with the 3 Image Types:

- ORIGINAL/PRIMARY/BREAST/0400
- ORIGINAL/PRIMARY/BREAST/0000/FLAT_TRANSVERSE
- ORIGINAL/PRIMARY/BREAST/0000/CURVED_PLANE

The value 4, “0000” indicates the GE proprietary encoding scemes.

When the Image Type (0008,0008) is encoded as:

- “/ORIGINAL/PRIMARY/BREAST/0000/Flat Transverse”,

the Private Group, General Electric Company 01is added if it previously did not exist. The SERIES/STUDY/Instance unique identifiers are not updated with this addition to the SOP Instance.

The Invenia ABUS Viewer recieving Ultrasound Multiframe Image Storage SOP Class objects, originating from an ABUS Scan Station, are updated without change to the unique identifiers assigned by the ABUS Scan Station with one exception:

- The Frame of Reference UID (0020,0052) is updated.

The Invenia ABUS Viewer sending the Ultrasound Multiframe Image Storage SOP Class objects, originating from an ABUS Scan Station, will send only the images with the Image Type:

- ORIGINAL/PRIMARY/BREAST/0000/FLAT_TRANSVERSE

The Invenia ABUS Viewer will not send US-MF images with the Image Types which include:

- ORIGINAL/PRIMARY/BREAST/0400
- ORIGINAL/PRIMARY/BREAST/0000/CURVED_PLANE

2.3.1.2.1.2.3 SOP Specific DICOM Conformance Statement for the Basic Text Structured Reporting, Storage SOP Classes

The Basic Text SR object containing the Invenia ABUS (SR) Structured Report is created when a study is imported to the local system.

When the SR is updated, the SOP Instance UID is not updated.

For ABUS images in the imported study with a Nipple Marker position specified (Private Group General Electic Company 01), the Nipple Marker is added in an update to the ABUS SR report findings.

When Markers are manually added to the study, including the marker characteristics, the markers and their characteristics are added in an update to the report findings.

When measurements are manually added in the Caliper Mode, to the study. The measurements are added in an update to the report finding.

When a worksheet is saved by the suspend action, the Invenia ABUS SR is updated with entries by the user.

When the worksheet is saved by the sign action, the Invenia ABUS SR is updated with entries by the user.

2.3.1.2.1.2.4 SOP Specific DICOM Conformance Statement for Ecapsulated PDF Implementation

See Section 2.3.1.2.2.1 “SOP Specific DICOM Conformance Statement for All Storage SOP Classes” for details on general Storage Service SCU processing also applicable to the Ultrasound Multi-frame Image Storage SOP Classes.

When the worksheet is saved by the sign action, the worksheet is saved as a PDF.

2.3.1.2.1.2.5 SOP Specific Conformance for the Secondary Capture Information Object Implementation

See Section 2.3.1.2.2.1 “SOP Specific DICOM Conformance Statement for All Storage SOP Classes” for details on general Storage Service SCU processing also applicable to the Ultrasound Multi-frame Image Storage SOP Classes.

When Markers are manually added to an image, a secondary capture is created showing the image view with the marker.

When measurements are manually added in the Caliper Mode, to an image, a secondary capture is created showing the image view of the caliper measurements.

When the viewer dislay is screen captured by the user, the image is saved as a secondary capture.

2.3.1.2.2 Real-World Activity: Query Remote AE

2.3.1.2.2.1 Associated Real-World Activity

The user queries a Remote database from the Study Browser by selecting a Remote Server from the pull down list of configured servers.

Remote Servers are configured in the DICOM configuration page as Q/R SCP Application Entities.

Selecting a Remote Server, will initiate the "Query" operation. The "Query" operation will cause the Invenia ABUS Viewer AE to initiate an association to the selected Remote Server AE.

The user may refine the 'Query" by entering specific search parameter criteria in the Study Browser and select "Search"

2.3.1.2.2.2 Proposed Presentation Context Table

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

Presentation Context Table – Proposed by AE Invenia ABUS Viewer 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.2.3 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.

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.

2.3.1.2.3 Real-World Activity: Retrieve Study

2.3.1.2.3.1 Associated Real-World Activity

Once a list of Study Imformation has been queried and displayed, the operator can invoke the "Retrieve" operation by choosingthe study(s) in the browser to retirieve and selecting the "Retrieve" button from the display.

Upon the retrieve request, the Invenia ABUS Viewer 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 imported locally. If the Study included an Invenia ABUS SR, then this will be used to determine the Study Status. If an Invenia SR does not exist, the Invenia ABUS Viewer will create an Invenia ABUS SR report locally as New. If the retrieved images include Nipple Position, the new study will include the Nipple Position of each image in the newly created report.

2.3.1.2.3.2 Proposed Presentation Context Table

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

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

2.3.1.2.3.2.1 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 Invenia ABUS Viewer . This implies that the remote C-MOVE SCP must be preconfigured to determine the presentation address corresponding to the Invenia ABUS Viewer.

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	

2.3.1.2.4 Real-World Activity: Echo Request

2.3.1.2.4.1 Associated Real-World Activity

Upon the search request, the Invenia ABUS Viewer 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.

2.3.1.2.4.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by AE Invenia ABUS Viewer 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		

2.3.1.2.4.3 SOP Specific Conformance to Echo SCU

The behavior of the Invenia ABUS Viewer 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.

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 Invenia ABUS Viewer 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.

Error condition	Behavior
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).	

2.3.1.2.5 Real-World Activity: Receive Image

2.3.1.2.5.1 Associated Real-World Activity

The Invenia ABUS Viewer may receive a C-STORE request by any C-STORE SCU.

Upon the C-STORE request, the Invenia ABUS Viewer opens a new, dedicated association. After the C-STORE request has been completed, the association is closed. The received images are stored locally. If the Study included an Invenia ABUS SR, then this will be used to determine the Study Status. If an Invenia SR does not exist, the Invenia ABUS Viewer will create an Invenia ABUS SR report locally as New. If the retrieved images include Nipple Position, the new study will include the Nipple Position of each image in the newly created report.

2.3.1.2.5.2 Accepted Presentation Context Table

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

Presentation Context Table - Accepted by AE Invenia ABUS Viewer 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 Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCP	None
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None
Basic Text Structured Report	1.2.840.10008.5.1.4.1.1.88.11	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None
Digital Mammography Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

Presentation Context Table - Accepted by AE Invenia ABUS Viewer for Activity Receive Image					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
		Lossless JPEG	1.2.840.10008.1.2.4.70		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Explicit VR Little Endian Implicit VR Little Endian Lossless JPEG	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.4.70	SCP	None
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

2.3.1.2.5.2.1 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	

2.3.1.2.6 Real-World Activity: Receive Echo Request

2.3.1.2.6.1 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE Invenia ABUS Viewer 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 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	SCP	None

2.3.1.2.6.2 SOP Specific Conformance to Echo SCP

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

2.3.1.2.6.3 Presentation Context Acceptance Criterion

No criterion.

2.3.1.2.6.4 Transfer Syntax Selection Policies

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

Within each Presentation Context, the Invenia ABUS Viewer 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 64 Bit Operating System.

2.4.2 Physical Media Support

The Invenia ABUS Viewer 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 Invenia ABUS Viewer 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 Invenia ABUS Viewer 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 CHARACTER SETS

The ABUS work station support character set for 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. QUERY IMPLEMENTATION

3.1 INVENIA ABUS VIEWER 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 3-1
MAPPING OF DICOM ENTITIES TO INVENIA ABUS VIEWER ENTITIES

DICOM	INVENIA ABUS VIEWER Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

3.2 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.

3.2.1 Common Query Keys

Upon the search request, the Invenia ABUS Viewer 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.

Q/R PATIENT LEVEL COMMON RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	SCU Use
Specific Character Set	(0008,0005)	-	Not Sent
Query Retrieve Level	(0008,0052)	-	IMAGE SERIES STUDY
Retrieve AE Title	(0008,0054)	-	Attribute is not requested. Returned value is ignored
Storage Media File-set ID	(0088,0130)	-	Attribute is not requested. Returned value is ignored
Storage Media File-set UID	(0088,0140)	-	Attribute is not requested. Returned value is ignored

3.2.2 Study Level – Study Root

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Patient ID	(0010,0020)	R*	Universal, Wildcard, Single value Matching

Patient Name	(0010,0010)	R*	Universal, Wildcard, Single value Matching
Accession Number	(0008,0050)	R	Universal
Study Instance UID	(0020,000D)	U	Single Value Mapping
Study Date	(0008,0020)	R*	Date Range Matching
Study Time	(0008,0030)	R	Universal
Study Description	0008,1030)	O	Universal
Patient's Birth Date	(0010,0030)	O*	Universal
Patient's Sex	(0010,0040)	O*	Universal
Study ID	(0020,0010)	R	Universal
Referring Physician's Name	(0008,0090)	O	Universal
Modalities in Study	(0008, 0061)	O*	Universal, Wildcard, Single value Matching
Admission ID	(0038,0010)	O	Universal

Note: * in the *Type* column indicates that this information is displayed on screen, if available

3.2.3 Series Level

This section defines the keys at the Series Level of the Study Root Query/Retrieve Information Models that are supported by this implementation.

TABLE 3-2
SERIES LEVEL ATTRIBUTES FOR THE QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Modality	(0008,0060)	R	Universal
Series Date	(0008,0021)	O	Universal
Laterality	(0020,0060)	O	Universal
Series Number	(0020,0011)	R	Universal
Series Instance UID	(0020,000E)	U	Universal
Study Instance UID	(0020,000D)	O	Single Value Matching
Software Version	(0018,1020)	O	Universal
Device Serial Number	(0018,1000)	O	Universal
Body Part Examined	(0018,0015)	O	Universal
Manufacturer's Model Name	(0008,1090)	O	Universal
Performing Physician's Name	(0008,1050)	O	Universal
Series Description	(0008,1040)	O	Universal
Series Time	(0008,0031)	O	Universal
Manufacturer	(0008,0070)	O	Universal
Institution Name	(0008,0080)	O	Universal
Station Name	(0008,1010)	O	Universal
Series Description	(0008,103E)	O	Universal
Series Instance UID	(0020,000E)	U	Single Value Matching

4. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 INVENIA ABUS VIEWER MAPPING OF DICOM ENTITIES

The Invenia ABUS Viewer 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

4.3 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
Patient	**Patient**	**Used**	Error! Reference source not found.
	Clinical Trial Subject	**Not Used**	**NA**
Study	**General Study**	**Used**	Error! Reference source not found.
	Patient Study	**Not Used**	**NA**
	Clinical Trial Study	**Not Used**	**NA**
Series	**General Series**	**Used**	**4.4.3.1**
	Clinical Trial Series	**Not Used**	**NA**
Equipment	**General Equipment**	**Used**	**4.4.4.1**
	SC Equipment	**Used**	**4.4.4.1**
Image	**General Image**	**Used**	**4.4.5.1**
	Image Pixel	**Used**	**4.4.5.2**
	Device	**Not Used**	**NA**
	SC Image	**Used**	**4.4.5.3**
	Overlay Plane	**Not Used**	**NA**
	Modality LUT	**Not Used**	**NA**
	VOI LUT	**Not Used**	**NA**
	SOP Common	**Used**	**4.4.5.4**

4.4 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.

4.4.1 Patient Entity Modules

4.4.1.1 Patient Module

PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From received image in Study Otherwise, sent empty
Patient ID	(0010,0020)	2	From received image in Study Otherwise, sent empty
Issuer of Patient ID	(0010,0021)	3	<empty>
Patient's Birth Date	(0010,0030)	2	From received image in Study Otherwise, sent empty
Patient's Sex	(0010,0040)	2	From received image in Study Otherwise, sent empty

Other Patient IDs	(0010,1000)	3	From received image in Study Otherwise, sent empty
Patient Comments	(0010,4000)	3	<empty>

4.4.2 Study Entity Modules

4.4.2.1 General Study Module

GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From received image in Study
Study Date	(0008,0020)	2	From received image in Study Otherwise, sent empty
Study Time	(0008,0030)	2	From received image in Study Otherwise, sent empty
Referring Physician's Name	(0008,0090)	2	From received image in Study Otherwise, sent empty
Study ID	(0020,0010)	2	From received image in Study Otherwise, sent empty
Accession Number	(0008,0050)	2	From received image in Study Otherwise, sent empty
Study Description	(0008,1030)	3	From received image in Study Otherwise, sent empty

4.4.3 Series Entity Modules

4.4.3.1 General Series Module

TABLE 3-5
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"OT"
Series Instance UID	(0020,000E)	1	System generated.
Series Number	(0020,0011)	2	System generated.
Series Date	(0008,0021)	3	Current date when series is created
Series Time	(0008,0031)	3	Current time when series is created
Series Description	(0008,103E)	3	Not sent
Operators' Name	(0008,1070)	3	Not sent
Body Part Examined	(0018,0015)	3	Not sent

4.4.4 Equipment Entity Modules

4.4.4.1 General Equipment Module

GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	"GE HEALTHCARE"

Institution Name	(0008,0080)	3	User entered, from *System Configuration*, *Setup* panel
Institution Address	(0008,0081)	3	User entered, from *System Configuration*, *Review*, *Review Form* Panel
Station Name	(0008,1010)	3	User entered, from *System Configuration*, *Local Settings* for AE Title
Institutional Department Name	(0008,1040)	3	<Empty>
Manufacturer's Model Name	(0008,1090)	3	"Invenia ABUS Viewer"
Software Version(s)	(0018,1020)	3	Invenia ABUS Viewer version

4.4.4.2 SC Equipment Module

SC EQUIPMENT MODULE ATTRIBUTES

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

4.4.5 Image Entity Modules

4.4.5.1 General Image Module

GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	System Generated
Patient Orientation	(0020,0020)	2C	empty
Content Date	(0008,0023)	2C	Current date when SC is created
Content Time	(0008,0033)	2C	Current time when SC is created
Image Type	(0008,0008	3	See 4.4.5.1.1
Acquisition Date	(0008,0022)	3	Current date when SC is created
Acquisition Time	(0008,0032)	3	Current time when SC is created
Acquisition DateTime	(0008,002A))	3	Current date Time when SC is created
Image Comments	(0020,4000)	3	<Empty>
Burned In Annotation	(0028,0301)	3	YES

4.4.5.1.1 Image Type

Image Type value 1 uses the enumerated value DERIVED

Image Type value 2 uses the value DOCUMENT

WARNING: Value 2 is using neither of the DICOM defined enumerated types, PRIMARY or SECONDARY.

4.4.5.2 Image Pixel Module

IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	3
Photometric Interpretation	(0028,0004)	1	RGB
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	SC Image Data
Planar Configuration	(0028,0006)	1C	0

4.4.5.3 SC Image Module

SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Date of Secondary Capture	(0018,1012)	3	Current date when SC is created
Time of Secondary Capture	(0018,1014)	3	Current time when SC is created

4.4.5.4 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	Not Sent
Instance Number	(0020,0013)	3	System generated

4.5 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. STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

This section specifies the use of the DICOM Basic Text SR IOD to represent results produced by this implementation. Corresponding attributes are conveyed using the module construct.

5.2 INVENIA ABUS VIEWER MAPPING OF DICOM ENTITIES

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

TABLE 5-1
MAPPING OF DICOM ENTITIES TO INVENIA ABUS VIEWER ENTITIES

DICOM IE	<Name of the Product> Entity
Patient	Patient
Study	Exam
Series	Series
Document	Document

5.3 IOD MODULE TABLE

The Basic Text, , Structured Report Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes are described in Section **Error! Reference source not found.**.

The contents of the SR Document Content are constrained by the supported template, as identified in Section **Error! Reference source not found.**. Standard, Standard Extended and Private templates are further described in Section **Error! Reference source not found.**.

TABLE 5-2
STRUCTURE REPORT IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	**Patient**	**Used**	Error! Reference source not found.
	Clinical Trial Subject	**Not Used**	**NA**
Study	**General Study**	**Used**	Error! Reference source not found.
	Patient Study	**Not Used**	**NA**
	Clinical Trial Study	**Not Used**	**NA**
Series	SR Document Series	Used	5.4.1.1
	Clinical Trial Series	**Not Used**	**NA**
Equipment	General Equipment	Used	**4.4.4.1**

Document	SR Document General	Used	5.4.2.1
	SR Document Content	Used	5.4.2.2
	SOP Common	Used	5.4.2.3

5.4 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 SR Information Objects.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported and 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.

5.4.1 Series Entity Modules

5.4.1.1 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	System Generated
Series Number	(0020,0011)	1	System Generated
Series Date	(0008,0021)	3	Date when instance is created or updated
Series Time	(0008,0031)	3	Time when instance is created or updated
Series Description	(0008,103E)	3	“Invenia ABUS SR with marker and caliper items”
Referenced Performed Procedure Step Sequence	(0008,1111)	2	<empty>

5.4.2 Document Entity Modules

5.4.2.1 SR Document General Module

SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Instance Number	(0020,0013)	1	System Generated, set to "1"
Completion Flag	(0040,A491)	1	PARTIAL
Verification Flag	(0040,A493)	1	UNVERIFIED
Content Date	(0008,0023)	1	Date when SR created or SR content is updated without change to SOP Instance UID
Content Time	(0008,0033)	1	Time when SR created or SR content is updated without change to SOP Instance UID

5.4.2.2 SR Document Content Module

This Section specifies the attributes that identify and describe the SR content.

NOTE : Coding Scheme, 99_OFFIS_DCMK, used by this application is from open source sample code. The coding scheme is private and defined by GE and not the authors of the sample code as implied by this Conformity Document.

5.4.2.2.1 Invenia ABUS SR

SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Value Type	(0040,A040)	1	"CONTAINER"
Continuity of Content	(0040,A050)	1C	"SEPARATE"
Concept Name Code Sequence	(0040,A043)	1C	

> Code Value	(0008,0100)	1	"SV_0.1"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Invenia ABUS SR "
Content Sequence	(0040,A730)	1C	If exists, the content may include containers, which containins: • Findings • Review Information • Impression • Summary • Action • Ammendment • ReprotingPhysician • ReportingDateTime As created for this study by the viewer

5.4.2.2.1.1 Findings

This contains Markers and the Findings Detail for this report.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_1.1"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Findings "
Continuity of Content	(0040,A050)	1C	"SEPARATE"

5.4.2.2.1.1.1 Marker

The marker is added by the user on an image.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_2.1"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Marker "

> Continuity of Content	(0040,A050)	1C	"SEPARATE"

5.4.2.2.1.1.1.1 Position

The position entry provides display coordinates for marker placement of referenced image.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_3.1."
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Position"
Continuity of Content	(0040,A050)	1C	"SEPARATE"

CAUTION: Use of Position coordinates is not consistent throughout this SR document.

X COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_4.1"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"X "
Text Value	(0040,A160)	1C	X coordinate position from 0 to 1

Y COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_4.2."
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Y "
Text Value	(0040,A160)	1C	Y coordinate position from 0 to 1

Z COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_4.3"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note

>Code Meaning	(0008,0104)	1	"Z"
Text Value	(0040,A160)	1C	Z coordinate position from 0 to 1

5.4.2.2.1.1.1.2 Description

The description is included in the Lesion Characteristics, entered in by the user as notes.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_3.2"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Description"
Text Value	(0040,A050)	1C	Default, "Not Specified"

5.4.2.2.1.1.1.3 Marker Type

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_3.3"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"MarkerType "
Text Value	(0040,A160)	1C	"Primary", "Arrow", "Secondary"

5.4.2.2.1.1.1.4 ReferenceSOPInstanceUID

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_3.4."
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"ReferenceSOPInstanceUID "
Text Value	(0040,A160)	1C	SOP Instance UID of referenced image

5.4.2.2.1.1.1.5 Calipers

Relationship Type	(0040,A010)	1	CONTAINS

Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	“SV_3.5”
> Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Calipers“
Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.1.1.6 GroupUID

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	“SV_3.6”
> Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“GroupUID“
Text Value	(0040,A160)	1C	Not Specified

5.4.2.2.1.1.1.7 Lesion Propery

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	“SV_3.7.”
> Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“LesionProperty“
Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.1.1.7.1 Shape

Shape is a Lesion Characteristic entered by the user entered by the user which may have a single defined value of either:

Round
Oval
Irregular

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.2”

>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Shape"
Text Value	(0040,A160)	1C	Default Value is "Undefined"

5.4.2.2.1.1.1.7.2 Orientation

Orientation is a Lesion Characteristic entered by the user which may have a single defined value of either:

Parallel
Nonparallel

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.3"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Orientation"
Text Value	(0040,A160)	1C	Default Value is "Undefined"

5.4.2.2.1.1.1.7.3 Margin

Margin is a Lesion Characteristic entered by the user which may have a single defined value of either:

Circumscribed
Indistinct
Angular
Microlobulated
Spiculated

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.4"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Margin"
Text Value	(0040,A160)	1C	Default Value is "Undefined"

5.4.2.2.1.1.1.7.4 Border

Border, or Boundary is a Lesion Characteristic entered by the user which may have a single defined value of either:

Echogenic Halo
Abrupt Interface

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.5”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Border“
Text Value	(0040,A160)	1C	Default Value is “Undefined”

5.4.2.2.1.1.1.7.5 Echo

Echo, or Ech Pattern is a Lesion Characteristic entered by the user which may have a single defined value of either:

Anechronic
Hyperechoic
Complex
Hypoechoic
Isoechoic

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.6”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Echo“
Text Value	(0040,A160)	1C	Default Value is “Undefined”

5.4.2.2.1.1.1.7.6 Posterior

Posterior is a Lesion Characteristic entered by the user which may have a single defined value of either:

None
Enhancement
Shadowing
Combined Pattern

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.7”

>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Posterior"
Text Value	(0040,A160)	1C	Default Value is "Undefined"

5.4.2.2.1.1.1.7.7 StructureDescription

StructureDescription, or Surrounding Tissue is a Lesion Characteristic entered by the user which may have a single defined value of:

No Findings

Or may one or multiple values, delinated with a ";" for the following:

Duct Changes
Architectural Distortion
Skin Thickening
Cooper's Ligament
Edema
Skin Retraction/Irregularity

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.8"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"StructureDescription "
Text Value	(0040,A160)	1C	Default Value is "Not Specified"

5.4.2.2.1.1.1.7.8 CalcificationDescription

CalcificationDescription, or Calcifications is a Lesion Characteristic entered by the user which may have a single defined value of:

No Microcalcifications

Or may one or multiple values deliniated with a ";" from the following:

Macrocalcifications
Microcalcifications in mass
Microcalcifications out of mass
Microcalcifications in duct

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.9"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note

>Code Meaning	(0008,0104)	1	"CalcificationDescription"
Text Value	(0040,A160)	1C	Default Value is "Not Specified"

5.4.2.2.1.1.1.7.9 LesionType

Lesion Type is a Lesion Characteristic entered by the user which may have a single defined value of either:

Cyst
Complex Cyst
Solid Mass
Lymph Node
Clustered Microcysts
Complicated Cyst
Skin Lesion

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.10"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"LesionType"
Text Value	(0040,A160)	1C	Default Value is "Not Specified"

5.4.2.2.1.1.1.7.10 Birads

Birads is a Lesion Characteristic entered by the user which may have a single defined value of either:

BI-RADS 0: Incomplete – Needs Additional Imaging Evaluation
BI-RADS 1: Negative
BI-RADS 2: Benign
BI-RADS 3: Probably Benighn
BI-RADS 4a: Low suspiciaon for Malignacy
BI-RADS 4b: Moderate suspicion for malignacy
BI-RADS 4c: High suspicion for malignacy
BI-RADS 5: Highly Suggestive of Malignacy
BI-RADS 6: Known Biopsy-Proven Malignacy

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.11"

>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Birads“
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.7.11 LikelihoodOfMalignancy

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.12”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“LikelihoodOfMalignancy“
Text Value	(0040,A160)	1C	Default Value is “-1”

5.4.2.2.1.1.1.7.12 Density

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.13”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Density“
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.7.13 CalcificationDistribution

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.14”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“CalcificationDistribution“
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.7.14 QuadraPosition

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.15”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“QuadraPosition" “
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.7.15 ClockPosition

ClockPosition is the relative direction of the marker with respect to the Nipple and the head described using the analogy of a 12-hour **clock** to describe angles and directions. This value is automatically calculated.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.16.”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ClockPosition “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.7.16 MammoDepth

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_5.17”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“MammoDepth “
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.7.17 DistanceToNipple

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT

>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.17"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"DistanceToNipple "
Text Value	(0040,A160)	1C	Default Value is "0"

5.4.2.2.1.1.1.7.1 DistanceToSkin

DistanceToSkin is the relative direction of the marker with respect to the Nipple and the head described using the analogy of a 12-hour **clock** to describe angles and directions. This value is automatically calculated.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_5.19"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"DistanceToSkin"
Text Value	(0040,A160)	1C	Default Value is "Not Specified"

5.4.2.2.1.1.1.8 Label

Label or Lesion is the system assigned identifier for user reference.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_3.8"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Label "
Text Value	(0040,A160)	1C	Default Value is "Not Specified"

5.4.2.2.1.1.1.9 RadiusC

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_3.9"

>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RadiusC“
Text Value	(0040,A160)	1C	Default Value is “3”

5.4.2.2.1.1.1.10 RadiusT

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.10”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RadiusT“
Text Value	(0040,A160)	1C	Default Value is “3”

5.4.2.2.1.1.1.11 RadiusS

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.11”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RadiusS “
Text Value	(0040,A160)	1C	Default Value is “3”

5.4.2.2.1.1.1.12 ViewName

ViewName is the View Name(0008,2127) of the image where the marker was placed.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.12”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ViewName “
Text Value	(0040,A160)	1C	Default Value is “Not Specified”

5.4.2.2.1.1.1.13 MarkerUID

MarkerUID is the UID assigned to the marker by the Invenia ABUS Viewer application.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.13”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“MarkerUID “
Text Value	(0040,A160)	1C	System Generated UID

5.4.2.2.1.1.1.14 CreatorName

CreatorName is the User Login name of the person logged into the Invenia ABUS Viewer application when the Marker was created.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.14”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“CreatorName “
Text Value	(0040,A160)	1C	User Login ID as time of creation

5.4.2.2.1.1.1.15 ArrowOrientation

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.20”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowOrientation “
Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.1.1.15.1 ArrowX

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.1”

>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowX “
Text Value	(0040,A160)	1C	X Arrow orientation

5.4.2.2.1.1.1.15.2 ArrowY

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.2”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowY “
Text Value	(0040,A160)	1C	Y Arrow orientation

5.4.2.2.1.1.1.15.3 ArrowZ

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.3”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowZ “
Text Value	(0040,A160)	1C	Z Arrow orientation

5.4.2.2.1.1.1.16 ArrowXYZ

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.21”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowXYZ “
Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.1.1.16.1 RX

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT

>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.1”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RX “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.16.2 RY

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.2”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RY “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.16.3 RZ

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_4.3”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“RZ “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.17 ArrowAngle

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.22”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowAngle “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.18 ArrowLegnth

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.23”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowLegnth “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.19 ArrowScale

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.24”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ArrowScale “
Text Value	(0040,A160)	1C	Default Value is “0”

5.4.2.2.1.1.1.20 PlaneType

Plane where the marker was placed by the user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_3.25”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“PlaneType “
Text Value	(0040,A160)	1C	Values may be “Coronal”, “Saggital” or “Transverse”

5.4.2.2.1.1.1.21 CreatedTime

Date/Time marker was created by user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT

>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_3.26"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"CreatedTime "
Text Value	(0040,A160)	1C	YYYYMMDDHHMMSS

5.4.2.2.1.1.1.22 UpdatedTime

Date/Time marker was created by user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_3.27"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"UpdatedTime "
Text Value	(0040,A160)	1C	YYYYMMDDHHMMSS

5.4.2.2.1.1.2 FindingsDetail

Findings Detail provides a summary of each marker as a finding as entered in the Worksheet. Automated Findings entry includes: Shape, Margin, Orientation, Boundrary, Echo Pattern, Posterior and Surrounding Tissue. Entry may be modified by user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_2.4"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"FindingsDetail "
Text Value	(0040,A160)	1C	Default text is "Not Specified"

5.4.2.2.1.2 Review Information

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_1.2"

>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Review Information “
Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.2.1 ReviewStatus

Intdiates wheter the Report is signed.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_2.3”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ReviewStatus “
Text Value	(0040,A160)	1C	If created, value=”Reviewed”

5.4.2.2.1.3 NipplePosition

Nipple position, as copied from each image in the study and updated by the user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	“SV_1.3”
> Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“NipplePosition“
> Continuity of Content	(0040,A050)	1C	“SEPARATE”

5.4.2.2.1.3.1 Position

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	“SV_3.1.”
> Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Position“
Continuity of Content	(0040,A050)	1C	“SEPARATE”

CAUTION: Use of Position coordinates is not consistent throughout this SR document.

X COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	"SV_4.1"
>Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"X "
Text Value	(0040,A160)	1C	X coordinate position in pixels

Y COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_4.2."
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Y "
Text Value	(0040,A160)	1C	Y coordinate position in pixels

Z COORDINATE OF POSITION

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_4.3"
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"Z"
Text Value	(0040,A160)	1C	Z coordinate position in pixels

5.4.2.2.1.3.2 ReferenceSOPInstanceUID

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
Concept Name Code Sequence	(0040,A043)	1C	
> Code Value	(0008,0100)	1	"SV_3.4."
> Coding Scheme Designator	(0008,0102)	1	"99_OFFIS_DCMTK" see note
>Code Meaning	(0008,0104)	1	"ReferenceSOPInstanceUID "
Text Value	(0040,A160)	1C	SOP Instance UID of referenced image

5.4.2.2.1.4 Impression

Impressions Detail provides a summary of each marker as an impression as entered in the Worksheet. Automated Impressions entry includes: Lesion type, BIRADS and notes. Entry may be modified by user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.4”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Impression “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.2.1.5 Summary

Summary is the reccomendations as entered by the user.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.5”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Summary “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.2.1.6 Action

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.6”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Action “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.2.1.7 Ammendment

Ammendment is the amendment added to the report by the user once the report was originally signed.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.7”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“Ammendment “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.2.1.8 ReportingPhysician

Reproting Physician is the user login at the moment the report is signed.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.8”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ReportingPhysician “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.2.1.9 ReportingDateTime

Reporting DateTime is the date/time at the moment the report is signed.

Relationship Type	(0040,A010)	1	CONTAINS
Value Type	(0040,A040)	1	TEXT
>Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	“SV_1.9”
>Coding Scheme Designator	(0008,0102)	1	“99_OFFIS_DCMTK” see note
>Code Meaning	(0008,0104)	1	“ReportingDateTime “
Text Value	(0040,A160)	1C	Default text is “Not Specified”

5.4.2.3 SOP Common Module

SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	System generated.
SOP Instance UID	(0008,0018)	1	System generated at creation.

Specific Character Set	(0008,0005)	1C	ISO_IR 100 = Latin Alphabet No. 1
Instance Creation Date	(0008,0012)	3	Date Instance Created or Updated
Instance Creation Time	(0008,0013)	3	Time Instance Created or Updated
Instance Creator UID	(0008,0014)	3	1.2.276.0.7230010.3.0.3.6.1
Coding Scheme Identification Sequence	(0008,0110)	3	
>Coding Scheme Designator	(0008,0102)	1	99_OFFIS_DCMTK
>Coding Scheme UID	(0008,010C)	1C	1.2.276.0.7230010.3.0.0.1
>Coding Scheme Name	(0008,0115)	3	OFFIS DCMTK Coding Scheme
Instance Number	(0020,0013)	3	Systen Generated.

6. ENCAPSULATED PDF IMPLEMENTATION

6.1 INTRODUCTION

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

6.2 INVENIA ABUS VIEWER MAPPING OF DICOM ENTITIES

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

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

6.3 IOD MODULE TABLE

The Encapsulated PDF Information Object Definition comprises the modules of the following table.

ENCAPSULATED PDF IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	**Patient**	**Used**	Error! Reference source not found.
	Clinical Trial Subject	**Not Used**	**NA**
Study	**General Study**	**Used**	Error! Reference source not found.
	Patient Study	**Not Used**	**NA**
	Clinical Trial Study	**Not Used**	**NA**
Series	**Encapsulated Document Series**	**Used**	**6.4.3.1**
	Clinical Trial Series	**Not Used**	**NA**
Equipment	**General Equipment**	**Used**	**5.4.4.1**
	SC Equipment	**Used**	**6.4.4.1**
Encapsulated Document	**Encapsulated Document**	**Used**	**7.5.1.1**
	SOP Common	**Used**	**7.5.1.2**

6.4 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.

6.4.1 Series Entity Modules

6.4.1.1 Encapsulated Document Series Module

ENCAPSULATED DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"OT"
Series Instance UID	(0020,000E)	1	System generated.
Series Number	(0020,0011)	2	System generated.
Series Description	(0008,103E)	3	Not sent
Operators' Name	(0008,1070)	3	Not sent
Body Part Examined	(0018,0015)	3	Not sent

6.4.2 Equipment Entity Modules

6.4.2.1 SC Equipment Module

SC EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use
Conversion Type	(0008,0064)	1	ABSENT
Modality	(0008,0060)	3	OT

WARNING: Type 1 element (0008,0064) is missing

6.4.3 Encapsulated Document Entity Modules

6.4.3.1 Encapsulated Document Module

ENCAPSULATED DOCUMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	<empty>
Content Date	(0008,0023)	2C	The date the document content creation was started.
Content Time	(0008,0033)	2C	The time the document content creation was started.
Acquisition DateTime	(0008,002A))	3	The dateime of report creation
Burned In Annotation	(0028,0301)	3	YES
Concept Name Sequence	(0040,A043)	2	ABSENT
MIME Type of Encapsulated Document	(0042,0012)	1	application/pdf
Encapsulated Document	(0042,0011)	1	*Encapsulated SomoViewer PDF Report*
Document Title	(0042,0010)	2	SomoViewer pdf report

WARNING: Type 1 element (0020,0013) is empty

WARNING Type 2 element (0040,A043) is missing

6.4.3.2 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	System Generated
Instance Creation Date	(0008,0012)	3	Date Instance Created
Instance Creation Time	(0008,0013)	3	Time Instance Created
Instance Number	(0020,0013	3	<empty>

7. US MULTI-FRAME INFORMATION OBJECT IMPLEMENTATION

7.1 INTRODUCTION

This section specifies the use of the DICOM US Image IOD to represent the information included in US Images produced by Invenia ABUS Scan Station, updated by the Invenia ABUS Viewer implementation. Corresponding attributes are conveyed using the module construct.

7.2 INVENIA ABUS SCAN STATION MAPPING OF DICOM ENTITIES

The Invenia ABUS Viewer 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

7.3 IOD MODULE TABLE

The Ultrasound Image Information Object Definition comprises the modules of the following table, plus Private attributes. Private attributes are described in Section 7.6.

US IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Not updated
	Clinical Trial Subject	Absent	NA
Study	General Study	Used	Not updated
	Patient Study	Used	NA
	Clinical Trial Study	Absent	NA
Series	General Series	Used	Not updated
	Clinical Trial Series	Absent	NA
Frame of Reference	Frame of Reference	Used	7.4.4.1

	Synchronization	Absent	NA
Equipment	General Equipment	Used	Not updated
Image	General Image	Used	Not updated
	Image Pixel	Used	Not updated
	Contrast/Bolus	Absent	NA
	Cine	Not Used	NA
	Multi-frame	Used	Not updated
	Frame Pointers	Absent	NA
	Palette Color Lookup Table	Absent	NA
	Device	Absent	NA
	US Region Calibration	Absent	NA
	US Image	Used	Not updated
	Overlay Plane	Absent	NA
	VOI LUT	Used	Not updated
	SOP Common	Used	Not updated

7.4 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.

Please refer to the Invenia ABUS Scan Station DICOM Conformance statement for the original conformance for creation of the image.

7.4.1 Patient Entity Modules

7.4.1.1 Patient Module

TABLE 3-2
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Displayed in Study Browser, image viewer, Worksheet. Not editable
Patient ID	(0010,0020)	2	Displayed in Study Browser, image viewer, Worksheet. Not editable
Patient's Birth Date	(0010,0030)	2	Displayed in Study Browser, Worksheet. Not editable
Patient's Sex	(0010,0040)	2	Displayed in Study Browser, Worksheet. Not editable
Other Patient IDs	(0010,1000)	3	Displayed in Study Browser. Not editable
Patient Comments	(0010,4000)	3	sent empty

7.4.2 Study Entity Modules

7.4.2.1 General Study Module

TABLE 3-4
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Not displayed or modified
Study Date	(0008,0020)	2	Displayed in Study Browser, image viewer, Worksheet. Not editable
Study Time	(0008,0030)	2	Displayed in Study Browser, image viewer, Work notsheet. Not editable
Referring Physician's Name	(0008,0090)	2	From MWL or entered from user interface, Otherwise, sent empty
Study ID	(0020,0010)	2	From MWL, using information in Requested Procedure ID (0040, 1001), otherwise system generated
Accession Number	(0008,0050)	2	From MWL, Otherwise, sent empty
Study Description	(0008,1030)	3	From MWL, using Requested Procedure Description (0032,1060) Otherwise, sent empty

7.4.3 Series Entity Modules

7.4.3.1 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. User may select unique for each series or unique for each view in study
Series Number	(0020,0011)	2	System generated.
Series Date	(0008,0021)	3	Current date when series is created
Series Time	(0008,0031)	3	Current time when series is created
Series Description	(0008,103E)	3	See section 7.4.3.1.1
Operators' Name	(0008,1070)	3	Scan System user Login name
Body Part Examined	(0018,0015)	3	"BREAST"

7.4.3.1.1 Series Description

Series Description is configurable to append the content of view Name(0008,2127) as the value.

The content is appended with "Coronal view series" when image type(0008,0008) value 5 is "Curved_Plane,

The content is appended with "Curved Transverse View Series" when image type(0008,0008) value 4 is "0400".

7.4.4 Frame Of Reference Entity Modules

7.4.4.1 Frame Of Reference Module

Images sharing the same Frame of Reference UID are created using common scanned acquisition data and are spatially related.

TABLE 7-3
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	See 7.5.4.1.1 for further explanation.
Position Reference Indicator	(0020,1040)	2	Not used

7.4.4.1.1 Frame Of Reference UID

The Frame of Reference UID may be used to spatially relate images with common scanned acquisition data. Common Images utilizing the same Frame of Reference UID, have the a common View Name (0008,2127). Image type(0008,0008) may specify images which include pixel data in a proprietary coordinate system. The relationship between images with the proprietary coordinate system is not specified in this document. Images with the standard Cartesian Coordinate System and be spatially related based standard DICOM attributes.

7.4.5 Equipment Entity Modules

7.4.5.1 General Equipment Module

TABLE 3-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	"GE HEALTHCARE"
Institution Name	(0008,0080)	3	Entered from user interface, Otherwise Empty
Station Name	(0008,1010)	3	Entered from user interface Otherwise Empty
Manufacturer's Model Name	(0008,1090)	3	"Invenia ABUS Viewer"
Software Version(s)	(0018,1020)	3	Invenia ABUS Viewer version

7.4.6 Image Entity Modules

7.4.6.1 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
Content Date	(0008,0023)	2C	Date when image acquired
Patient Orientation	(0020,0020)	2C	See section 7.4.6.1.1
Content Time	(0008,0033)	2C	Time when image was acquired
Image Type	(0008,0008)	3	See section 7.4.6.1.2
Derivation Description	(0008,2111)	3	See section 7.5.1.1.1
Derivation Code Sequence	(0008,9215)	3	See section 7.5.1.1.2
> Code Value	(0008,0100)	1C	See section 7.5.1.1.2
> Coding Scheme Designator	(0008,0102)	1C	See section 7.5.1.1.2
> Code Meaning	(0008,0104)	1	See section 7.5.1.1.2
Image Icon Sequence	(00888,0200)	3	
>Samples per Pixel	(0028,0002)	1	1
>Photometric Interpretation	(0028,0004)	1	MONOCHROME2
>Rows	(0028,0010)	1	300
>Columns	(0028,0011)	1	300
>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 Icon Pixel data

7.4.6.1.1 Patient Orientation

Patient Orientation has a VR of 2. Values may include the capital letters:

- A (anterior)

- P (posterior)
- L(left)
- R (right)

7.4.6.1.2 Image Type

For Value 1, only "ORIGINAL" is supported.

For Value 2, only "PRIMARY" is supported.

For value 3, only "BREAST" is supported.

For Value 4, the bit maps supported are,

- 0000 – GE Proprietary Spatial Coordinate Systems
- 0400 – Spatially Related Frames

Value 5 is a modifier for when value 4=0000 (GE Proprietary Spatial Coordinate System)

- FLAT_TRANSVERSE
- CURVED_PLANE

The GE proprietary spatial coordinate system is not defined in the DICOM standard. Images are intended for processing/display by compatible devices, such as the Invenia ABUS Viewer.

7.4.6.1.3 Derivation Description

When Lossless JPEG compression is applied to the Pixel Data, the system automatically populates this field with the compression type, selection value, point transform, and resulting compression ratio. The image type is "ORIGINAL" and not "DERIVED". The automatic generation of this content is retained. Otherwise, this attribute is not used when the image type is "ORIGINAL".

7.4.6.1.4 Derivation Code Sequence

When Lossless JPEG compression is applied to the Pixel Data, the system automatically populates this sequence with

- Code Value: 121327
- Coding Scheme Designator: DCM
- Code Meaning: Full Fidelity Image

The image type is "ORIGINAL" and not "DERIVED". The automatic generation of this content is retained. Otherwise, this attribute is not used when the image type is "ORIGINAL".

7.4.6.2 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

7.4.6.3 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	Spacing Between Slices (0018,0088)

7.4.6.4 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
Frame Increment Pointer	(0028,0009)	1	Spacing Between Slices (0018,0088)
Image Type	(0008,0008)	2	See section 7.4.6.2.1
View Name	(0008,2127)	3	See section 7.4.6.4.1
Transducer Data	(0018,5010)	3	Transducer specific
Mechanical Index	(0018,5022)	3	Transducer Specific
Soft Tissue Thermal Index	(0018,5027)	3	Transducer Specific

7.4.6.4.1 View Name

View Name is set by the acquisition protocol selected by the user. The value may be one of the following:

View Type	Description	View Type	Description
RAP	Right Anterior Posterior	LAP	Left Anterior Posterior
RAX	Right Axilla	LAX	Left Axilla
RLAT	Right Lateral	LLAT	Left Lateral
RMED	Right Medial	LMED	Left Medial

RINF	Right Inferior	LINF	Left Inferior
RSUP	Right Superior	RSUP	Right Superior
RUOQ	Right Upper Outer Quadrant	LUOQ	Left Upper Outer Quadrant
RUIQ	Right Upper Inner Quadrant	LUIQ	Left Upper Inner Quadrant
RLOQ	Right Lower Outer Quadrant	LLOQ	Left Lower Outer Quadrant

7.4.6.5 VOI LUT

TABLE 7-12
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	1C	Sequence Not created
>LUT Descriptor	(0028,3002)	1	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1	
Window Center	(0028,1050)	1C	Protocol defined preset value.
Window Width	(0028,1051)	1C	Protocol defined preset value.
Window Center & Width Explanation	(0028,1055)	3	Not used.

7.4.6.6 SOP Common Module

TABLE 3-13
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SOP Class of Instance created
SOP Instance UID	(0008,0018)	1	System generated
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Creation Date	(0008,0012)	3	Date Instance Created
Instance Creation Time	(0008,0013)	3	Time Instance Created
Instance Number	(0020,0013)	3	System generated Instance Number

7.5 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

7.5.1 Standard Attributes

The Product supports the following attributes, not specified in the US Multi-Frame IOD, in SOP Instances as Type 3 data elements.

TABLE 7-14
STANDARD EXTENDED ATTRIBUTES

Information Entity Name	Attribute Name	Tag	Use
Image	Pixel Spacing	(0028,0030)	adjacent row spacing and adjacent column spacing in mm
	Spacing Between Slices	(0018, 0088)	Spacing between two slices in mm
	Slice Thickness	(0018,0050)	Thickness between two slices in mm
	Transducer Frequency	(0018,6030)	Transducer Dependent
	Image Position (Patient)	(0020,0032)	Image position for acquisition
	Image Orientation(Patient)	(0020,0037)	Image orientation for acquisition
	Image Laterality	(0020,0062)	L or R (BREAST)
	Derivation Description	(0008,2111)	See section 7.5.1.1.1
	Derivation Code Sequence	(0008,9215)	See section 7.5.1.1.2
	> Code Value	(0008,0100)	See section 7.5.1.1.2
	> Coding Scheme Designator	(0008,0102)	See section 7.5.1.1.2
	> Code Meaning	(0008,0104)	See section 7.5.1.1.2

7.5.1.1.1 Derivation Description

When Lossless JPEG compression is applied to the Pixel Data, the system automatically populates this field with the compression type, selection value, point transform, and resulting compression ratio. The image type is "ORIGINAL" and not "DERIVED". The automatic generation of this content is retained. Otherwise, this attribute is not used when the image type is "ORIGINAL".

7.5.1.1.2 Derivation Code Sequence

When Lossless JPEG compression is applied to the Pixel Data, the system automatically populates this sequence with

- Code Value: 121327
- Coding Scheme Designator: DCM
- Code Meaning: Full Fidelity Image

The image type is "ORIGINAL" and not "DERIVED". The automatic generation of this content is retained. Otherwise, this attribute is not used when the image type is "ORIGINAL".

7.5.2 Private Group: General Electric Company

Private Group, "General Electric Company" is modeled as part of the Image Information Entity.

TABLE 7-15
PRIVATE GROUP: GENERAL ELECTRIC COMPANY

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0021,0010)	LO	1	General Electric Company 01
Nipple Position	(0021,1020)	DS	3	X/Y/Z pixel coordinates of the Nipple Marker Position
First Element Position	(0021,1021)	SH	1	Side of the image that the first element is on (L (left) or R (right))
Curvature Radius (Probe)	(0021,1040)	DS	1	Radius of curvature of the ABUS transducer in mm
Curvature Radius (Track)	(0021,1041)	DS	1	Radius of curvature of the track that probe movement follows in mm
Region Arc Angle	(0021,1050)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Arc Angle	(0021,1051)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Inner Radius	(0021,1052)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Offset Orientation	(0021,1053)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Offset X	(0021,1054)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Offset Y	(0021,1055)	DS	1	Used by the renderer of GE Proprietary Scan Data
Region Outer Width	(0021,1056)	DS	1	Outer width of the region displayed by the renderer of GE Proprietary Scan Data
Region Width	(0021,1057)	DS	1	Width of the volume displayed by the renderer of GE Proprietary Scan Data
Region Height	(0021,1058)	DS	1	Height of the volume displayed by the renderer of GE Proprietary Scan Data
Region Depth	(0021,1059)	DS	1	Depth of the volume displayed by the renderer of GE Proprietary Scan Data
Steering Angle	(0021,1060)	DS	1	Ultrasound beam steering angle in degrees
Max Cut	(0021,1061)	DS	1	Number of padding elements represented in normalized length
Line Density	(0021,1062)	DS	1	Number of ultrasound scan lines per transducer element
Scan Depth	(0021,1063)	DS	1	Depth of scan in cm
ABUSApp Build Number	(0021,1064)	SH	1	Software build number
Elevation Scanned Ratio	(0021, 1065)	DS	1	Ratio between the distance scanned to the full scan plane distance. Used by renderer of GE Proprietary Scan Data.
Compression Level	(0021,1090)	SH	1	Level of mechanical compression on the breast during an ABUS scan (F, L, M, H)
Ball joint lock status while scanning	(0021,1091)	SH	1	Whether the ball joint was locked while scanning

Attribute Name	Tag	VR	VM	Attribute Description and Use
TEA	(0021,10A0)	SH	1	Tissue equalization algorithm (True or False)
SRI	(0021,10A2)	LO	1	Version of the speckle reduction imaging, if any (Null, Speckle 1, or Speckle 2)
Nipple Marker Update Allowed	(0021,10C0)	SH	1	Nipple marker update is not allowed for a volume scanned with In-progress send option.

7.5.3 Private Group General Electric Company 02

Private Group General Electric Company 02 is modeled as part of the Image Information Entity.

TABLE 7-15
PRIVATE GROUP GENERAL ELECTRIC COMPANY 01

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0021,0011)	LO	1	General Electric Company 02
Breast Border Geometry	(0021,1100)	OB	1	Used by renderer of GE Proprietary Scan Data.
Chest Wall Geometry	(0021,1110)	OB	1	Used by renderer of GE Proprietary Scan Data.
Rib Geometry	(0021,1120)	OB	1	Used by renderer of GE Proprietary Scan Data.
Histogram Peak Value	(0021,1130)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Lower Range	(0021,1132)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Upper Range	(0021,1133)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Average SD	(0021,1134)	FD	1	Used by renderer of GE Proprietary Scan Data.

7.5.4 Frame Of Reference Entity Modules

7.5.4.1 Frame Of Reference Module

Images sharing the same Frame of Reference UID are created using common scanned acquisition data and are spatially related.

TABLE 7-4
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	See 7.5.4.1.1 for further explanation.
Position Reference Indicator	(0020,1040)	2	Not used

7.5.4.1.1 Frame Of Reference UID

The Frame of Reference UID may be used to spatially relate images with common scanned acquisition data. Common Images utilizing the same Frame of Reference UID, have the a common View Name (0008,2127). Image type(0008,0008) may specify images which include pixel data in a proprietary coordinate system. The relationship between images with the proprietary coordinate system is not specified in this document. Images with the standard Cartesian Coordinate System and be spatially related based standard DICOM attributes.

7.6 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

7.6.1 Private Group General Electric Company 02

Private Group General Electric Company 02 is modeled as part of the Image Information Entity.

TABLE 7-15
PRIVATE GROUP GENERAL ELECTRIC COMPANY 01

Attribute Name	Tag	VR	VM	Attribute Description and Use
Private Creator Identification	(0021,0011)	LO	1	General Electric Company 02
Breast Border Geometry	(0021,1100)	OB	1	Used by renderer to mask non-tissue features in raw image data coordinate .
Chest Wall Geometry	(0021,1110)	OB	1	Used by renderer of GE Proprietary Scan Data.
Rib Geometry	(0021,1120)	OB	1	Used by renderer of GE Proprietary Scan Data.
Histogram Peak Value	(0021,1130)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Lower Range	(0021,1132)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Upper Range	(0021,1133)	FD	1	Used by renderer of GE Proprietary Scan Data.
Histogram Average SD	(0021,1134)	FD	1	Used by renderer of GE Proprietary Scan Data.