volpara®solutions™

Digital health services for the early detection of breast cancer

DICOM Conformance Statement (Multi-Product)

VolparaServer 1.3

Volpara Algorithm 1.5.2, 1.5.3, 1.5.4 & 1.5.5

VolparaDensity 3.2, 3.3 & 3.4

VolparaDoseRT 3.2, 3.3 & 3.4

Volpara Data Manager 1.0 & 1.1

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1 CONFORMANCE STATEMENT OVERVIEW

VolparaServer 1.3 provides clinically integrated access to the Volpara® breast tissue analysis tools, which assist radiologists in the analysis of digital mammograms.

This document specifies conformance to the DICOM Standard 2017 of the following Volpara Solutions applications that run in the context of VolparaServer (as well as certain aspects of the Volpara Data Manager research platform):

Product	DI component of UDI
VolparaServer 1.3.x	09421904268074
VolparaDensity 3.2 (Volpara Algorithm 1.5.2.x)	09421904268029
VolparaDensity 3.3 (Volpara Algorithm 1.5.3)	09421904268098
VolparaDensity 3.3x (Volpara Algorithm 1.5.4)	09421904268098
VolparaDensity 3.4.x (Volpara Algorithm 1.5.5.x)	9421904268166
VolparaDoseRT 3.2	09421904268036
VolparaDoseRT 3.3	09421904268104
VolparaDoseRT 3.4	09421904268173

VolparaServer implements the necessary DICOM services for interoperability between Volpara and products from other vendors. The following table provides an overview of the network services supported by VolparaServer.

DICOM SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Digital Mammography X-Ray Image Storage -- For Processing	***No***	***Yes (Note 1)***
Secondary Capture Image Storage	***Yes***	***Yes (Note 3)***
Mammography CAD SR	***Yes***	***No***

Notes:

1. The “Digital Mammography X-Ray Image Storage – For Processing” SOP Class is used for both conventional 2D mammography, and 3D mammography (tomosynthesis) from manufacturers other than Hologic.

2. The “Secondary Capture Image Storage” SCP capability is provided in order to process Hologic Tomosynthesis raw projection images encoded as SC Images.

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3 INTRODUCTION

Volpara accepts “For Processing” image objects containing digital mammography and tomosynthesis pixel data as a Service Class Provider (SCP) of the corresponding Storage Service Class. The software calculates factors such as volumetric breast density from the pixel data and DICOM header information. It also calculates other parameters such as applied pressure and average per-image dose. The results are exported as a Service Class User (SCU) of Storage Service Classes for the different result types.

Volpara provides a flexible means of “accepting “For Processing” projection images from tomosynthesis as manufacturers are inconsistent in how they provide that data. For instance, while some manufacturers produce “For Processing” projection images in ‘DICOM Digital Mammography Image Storage – For Presentation’ form, Hologic encodes all the projection images into a single Secondary Capture (SC) Image object instances.

3.1 Revision History

Revision	Date	Author	Description
1	7 June 2016	Volpara Health Technologies - Engineering	First multi-product web edition for VolparaServer 1.3 product family.
2	25 Jan 2017	Volpara Health Technologies - Engineering	Update for VolparaDensity 3.3 and related products.
3	8 Sep 2017	Volpara Health Technologies - Engineering	Update for VolparaDensity 3.3.1 and related products.
4	26 Jun 2020	Volpara Health Technologies - Product	Update for VolparaDensity 3.4.1 and related products, removed support for Breast Projection Object SOP Class UID

3.2 Audience

This document is written for the people that need to understand how VolparaServer and related products will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between VolparaServer and related products, and other DICOM products provided by other manufacturers. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.

- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. *Examples:* Verification SOP Class, Modality Work List Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Context – the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Application Entity (AE) – an endpoint 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.

Association – a network communication channel set up between Application Entities.

Attribute – a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

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 work list 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 work list SCU), imaging workstation (image query/retrieve SCU).

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in an 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) [PixelData], (0019,0210) [private data element].

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: JPEG-LS compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific objector 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.

3.5 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two Application Entities (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called Presentation Contexts. The receiving Application Entity accepts the *Presentation Contexts* it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on Roles – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for work lists and lists of stored images, transfer of image

objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

3.6 Abbreviations

AE Application Entity

AET Application Entity Title

CSE Customer Service Engineer

CR Computed Radiography

DHCP Dynamic Host Configuration Protocol

DICOM Digital Imaging and Communications in Medicine

DNS Domain Name System

DX Digital X-ray

HIS Hospital Information System

HL7 Health Level 7 Standard

IHE Integrating the Healthcare Enterprise

IOD Information Object Definition

IPv4 Internet Protocol version 4

IPv6 Internet Protocol version 6

ISO International Organization for Standards

JPEG Joint Photographic Experts Group

LUT Look-up Table

MG Mammography (X-ray)

O Optional (Key Attribute)

OSI Open Systems Interconnection

PACS Picture Archiving and Communication System

PDU Protocol Data Unit

R Required (Key Attribute)

RIS Radiology Information System.

SC Secondary Capture

SCP Service Class Provider

SCU Service Class User

SOP Service-Object Pair

SR Structured Reporting

TCP/IP Transmission Control Protocol/Internet Protocol

U Unique (Key Attribute)

UL Upper Layer

VR Value Representation

3.7 References

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

4 NETWORKING

4.1 Implementation Model

4.1.1 Application Data Flow

Figure 1 depicts the Application Entities (AEs) and their relationship into the Real-World Activities:

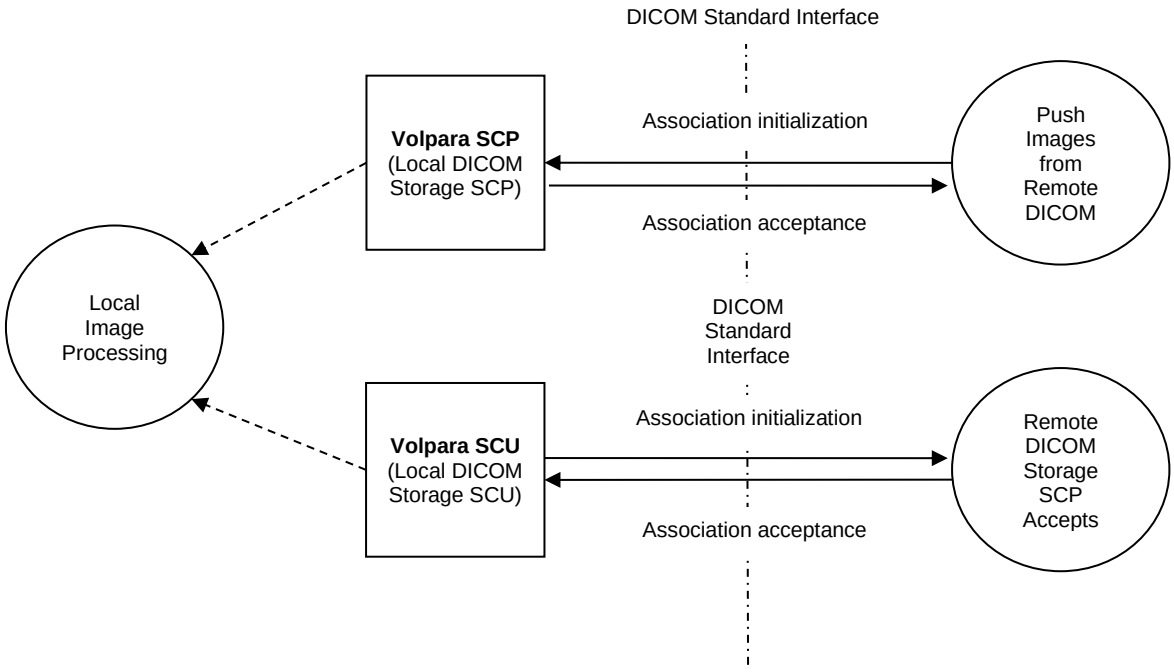

Figure 1. Application data flow diagram

The following AEs, sharing the same AE Title, are provided by VolparaServer:

- **Volpara SCP:** *Volpara SCP* (the Local DICOM Storage SCP) is started at system startup. A Remote DICOM Storage SCU initiates a push of images to *Volpara SCP*. Each image accepted is passed to Local Image Processing.

- **Volpara SCU:** *Volpara SCU* (the Local DICOM storage SCU) is started at system startup. Upon completion of image processing, the results pass to *Volpara SCU*, which pushes the results (and/or forwards raw images) to a Remote DICOM Storage SCP.

Images that are accepted by the *Volpara SCP* are stored temporarily, until processing is completed and the results are exported successfully. VolparaServer can also be configured to retain images for later analysis.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of Volpara SCP

Volpara SCP implements a Service Class Provider (SCP) for the Storage Service Class. It listens on a specific TCP/IP port for incoming association requests from a Storage Service Class User (SCU) and can receive DICOM images. Volpara SCP also supports the Verification Service Class as an SCP.

4.1.2.2 Functional Definition of Volpara SCU

Volpara SCU implements a Service Class User (SCU) for the Storage Service Class. For each DICOM file on the command line it sends a C-STORE message to a Storage Service Class Provider (SCP) and waits for a response. The application can be used to transmit DICOM images and other DICOM composite objects.

4.1.3 Sequencing of Real-World Activities

4.1.3.1 Local Image Processing

Local image processing is triggered when an image is sent from the modality or another DICOM entity. As illustrated in Figure 2, the following steps occur:

- The *Volpara SCP* AE receives a DICOM association initiation and selects a matching Presentation Context (Abstract Syntax and Transfer Syntax).
- The *Volpara SCP* AE accepts an association and waits for a C-STORE request.
- Upon receiving a C-STORE request, the *Volpara SCP* validates the attributes in the message, stores the image object to disk, and queues the image for processing.
- The *Volpara SCP* sends a C-STORE response. If configured to do so, it can also forward the received instance to the Volpara SCU, in order to send it to one or more SCPs such as a PACS or additional post-processing application.
- The image processing occurs.
- Upon completion of image processing, the Volpara Application results are formatted into one or more of a Mammography CAD Structured Report, one or two Secondary Capture Images (monochrome or RGB), and X-Ray Radiation Dose SR (depending on configuration and licensed applications).
- The *Volpara SCU* initiates an association to one or more remote applications.
- For each association, the *Volpara SCU* sends a C-STORE request containing the DICOM instance, waits for a C-STORE response, and closes the association.

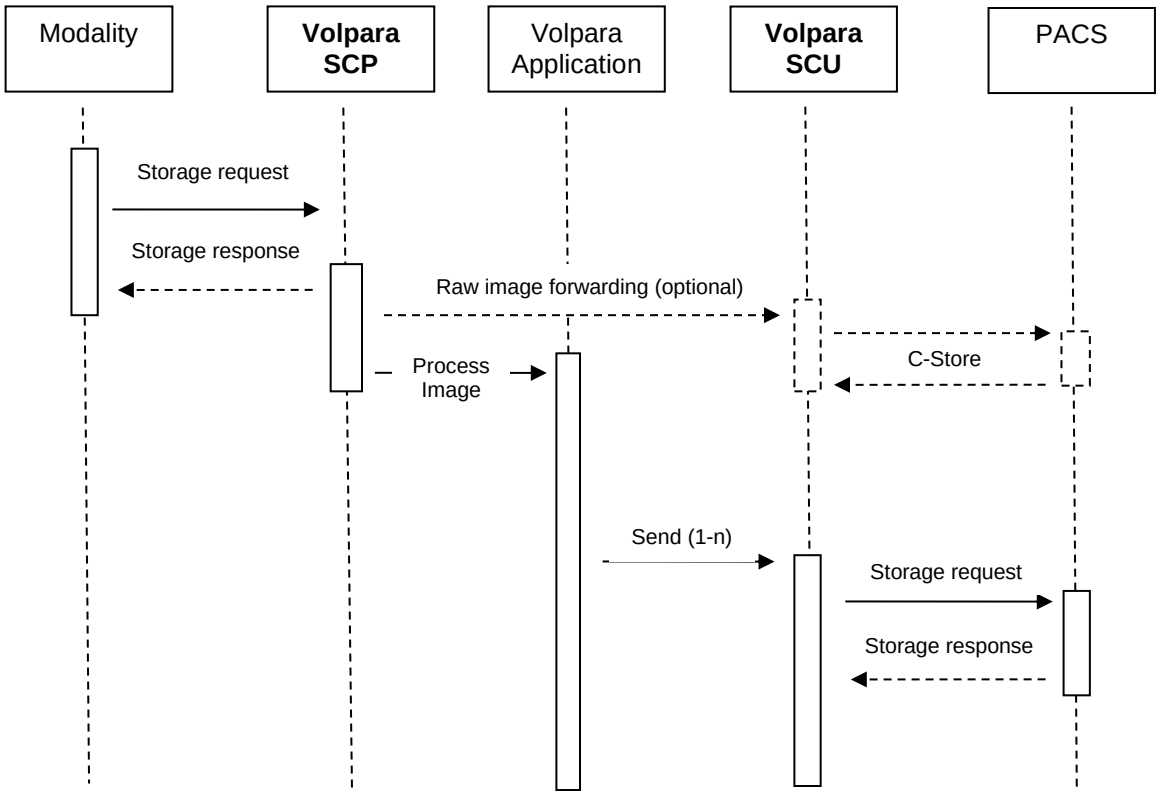

Figure 2. Sequencing of workflow

4.2 AE Specifications

4.2.1 Volpara SCP Application Entity Specification

4.2.1.1 SOP Classes

Volpara SCP provides Standard Level 2 (Full) Conformance to the following DICOM SOP Classes.

SOP Classes	SOP Class UID	SCU	SCP
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	***No***	***Yes (Note 1)***
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	***No***	***Yes (Note 3)***
Verification SOP Class	1.2.840.10008.1.1	***No***	***Yes***

Notes:

1. The “Digital Mammography X-Ray Image Storage – For Processing” SOP Class is used for both conventional 2D mammography, and 3D mammography (tomosynthesis) from manufacturers other than Hologic.

2. SC Image Storage SCP capability is only provided in order to process Hologic Tomosynthesis projection images encoded as SC Images.

4.2.1.2 Association Policies

4.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

DICOM application context for Volpara SCP	
Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The number of simultaneous associations that Volpara SCP will accept is limited by the kernel parameters of the underlying TCP/IP implementation and by a configurable parameter in one of the configuration files.

Number of associations as an association initiator for Volpara SCP	
Maximum number of simultaneous associations	6 (configurable)

Volpara SCP does not initiate associations.

4.2.1.2.3 Asynchronous Nature

Volpara SCP does not support asynchronous communication (multiple outstanding transactions over a single Association).

Asynchronous nature as an SCP for Volpara SCP	
Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

Implementation identifying information for Volpara SCP	
Implementation Class UID	1.2.826.0.1.3680043.8.694
Implementation Version Name	"VSS 1.3-*bld*" (where *bld* is the build number)

4.2.1.3 Association Initiation Policy

Volpara SCP does not initiate associations.

4.2.1.4 Association Acceptance Policy

4.2.1.4.1 Activity - Receive Images from a Remote DICOM Storage SCU

4.2.1.4.1.1 Description and Sequencing of Activities

The Real-World Activity "Push images" (DICOM C-Store) from the Remote DICOM Storage SCU triggers a C-STORE operation in Volpara SCP. This results in the storage and subsequent processing of the received images on Volpara. The C-STORE SCP operation will respond with a failure status if it is unable to store the images.

Volpara SCP accepts an association when it receives a valid association request, with at least one matching presentation context. If the number of simultaneous associations has reached the maximum, an association request remains suspended (i.e., no response is returned) until an opened association is closed or the remote SCU aborts the association.

The Volpara SCU may reject association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the appropriate fields of an ASSOCIATE-RJ PDU (see Section 9.3.4 in PS3.8). The contents of the Source column are abbreviated to save space; the abbreviations are as follows:

a - DICOM UL service-user

b - DICOM UL service-provider (ASCE-related function)

c - DICOM UL service-provider (presentation-related function)

Result	Source	Reason/Diag	Explanation
1 - rejected-permanent	a	2 - application-context-name-not-supported	The association request contained no supported Application Contexts (combinations of Storage SOP Class and Transfer Syntax). An association request with the same parameters will not succeed at a later time.
1 - rejected-permanent	a	7 - called-AE-title-not-recognized	The association request contained an unrecognized Called AE Title. An association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the association initiator is incorrectly configured and attempts to address Volpara using the wrong AE Title.
1 - rejected-permanent	a	3 - calling-AE-title-not-recognized	The association request contained an unrecognized Calling AE Title. An association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when Volpara has not been configured to recognize the AE Title of the association initiator.
1 - rejected-permanent	b	1 - no-reason-given	The association request could not be parsed. An association request with the same format will not succeed at a later time.

4.2.1.4.1.2 Accepted Presentation Contexts

Volpara SCP accepts the Presentation Contexts shown in the following table:

Abstract Syntax name/UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Digital Mammography X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	JPEG-LS Lossless Image Compression	***1.2.840.10008.1.2.4.81***	***SCP***	***None***
	JPEG 2000 Image Compression (Lossless Only)	***1.2.840.10008.1.2.4.90***	***SCP***	***None***
	Explicit VR Little Endian	***1.2.840.10008.1.2.1***	***SCP***	***None***
	Implicit VR Little Endian	***1.2.840.10008.1.2***	***SCP***	***None***
Secondary Capture Image Storage (Hologic) 1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	***1.2.840.10008.1.2.1***	***SCP***	***None***
	Implicit VR Little Endian	***1.2.840.10008.1.2***	***SCP***	***None***
Verification 1.2.840.10008.1.1	Implicit VR Little Endian	***1.2.840.10008.1.2***	***SCP***	***None***

When presented with multiple Transfer Syntaxes within one requested Presentation Context, the Volpara SCP accepts the supported syntaxes in the order of the list in the above table (i.e., it employs “SCP Priority”).

Volpara SCP is configured to not accept any lossy Transfer Syntaxes.

4.2.1.4.1.3 SOP Specific Conformance for All Storage SOP Classes

All Storage SOP Classes supported by Volpara SCP exhibit the same association acceptance behavior. The following table lists the possible values for the Status (0000, 0900) attribute of the C-STORE response:

Service status	Further meaning	Error code	Reason
Success	Success	0000	The DICOM instance was successfully received and stored in the local system.

Failure	Out of Resources	A700	Application out of memory, file system or database write error (e.g., disk full). The DICOM instance was not stored. An error message is output in the service logs.
Failure	Data Set does not match SOP class	A900	The SOP Class UID or SOP Instance UID in the C-STORE-RQ does not match the corresponding UID in the received dataset. The DICOM instance was not stored.
Failure	Cannot understand	C000	The received DICOM instance did not include a SOP Class UID or SOP Instance UID. The DICOM instance was not stored. An error message is output to the service logs.

In addition, if an SC Image is received that does not encode a tomosynthesis raw projection, the following code shall be returned:

Service status	Further meaning	Error code	Reason
Failure	SOP Class Not Supported	0122	The DICOM instance is not a supported SOP Class (For Processing mammography image or SC Image). If required, Volpara can be configured to silently accept all Storage Classes.
Failure	Processing Failure	0110	The DICOM SC Image instance did not encode a Tomosynthesis raw projection.

4.2.1.4.1.4 SOP Specific Conformance for Digital Mammography X-Ray Image Storage – For Processing

VolparaServer places constraints on the presence and values for specific attributes in “for processing” mammography instances used as input for breast density calculations.

These constraints are specified in Section 9.1.2.

4.2.2 Volpara SCU Application Entity Specification

4.2.2.1 SOP Classes

Volpara SCU provides Standard Conformance to the following DICOM SOP Classes.

SOP Classes	SOP Class UID	SCU	SCP
Volpara Results			
Mammography CAD SR Storage	1.2.840.10008.5.1.4.1.1.88.50	***Yes***	***No***
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	***Yes***	***No***
Raw Image Forwarding			
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	***Option (Note 1)***	***No***
Secondary Capture Image Storage (Hologic)	1.2.840.10008.5.1.4.1.1.7	***Option (Note 1)***	***No***

Note 1: Raw image forwarding is enabled for on a per-modality basis using the Volpara Dashboard.

4.2.2.2 Association Policies

4.2.2.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed:

DICOM Application Context for Volpara SCU	
Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations

Volpara SCU initiates one Association at a time for each destination to which a transfer request is being processed in the active job queue list. Only one job will be active at a time, the other remains pending until the active job is completed or failed.

Number of Associations as an Association Initiator for Volpara SCU	
Maximum number of simultaneous associations	1

4.2.2.2.3 Asynchronous Nature

Volpara SCU does not support asynchronous communication (multiple outstanding transactions over a single Association).

Asynchronous nature as an SCU for Volpara SCU	
Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4 Implementation Identifying Information

Implementation identifying information for Volpara SCU	
Implementation Class UID	1.2.826.0.1.3680043.8.694
Implementation Version Name	“VSS 1.3-*bld*” (where *bld* is the build number)

4.2.2.3 Association Initiation Policy

4.2.2.3.1 Activity - Send Results to a Remote DICOM Storage SCP

4.2.2.3.1.1 Description and Sequencing of Activities

Volpara SCU is invoked by the job control interface that is responsible for processing generated reports. A C-STORE SCU operation on a new association is triggered for each generated report which initiates the sending of results to a Remote DICOM Storage SCP. The DICOM targets for each report type are configured using the VolparaServer dashboard. If a transfer fails, VolparaServer will retry the send operation at a configurable interval, for a configurable number of times.

4.2.2.3.1.2 Proposed Presentation Contexts

Volpara SCU is capable of proposing the Presentation Contexts shown in the following table:

Abstract Syntax name/UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Volpara Results				
Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Mammography CAD SR 1.2.840.10008.5.1.4.1.1.88.50	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Raw Image Forwarding				
Digital Mammography X-Ray Image Storage – For Processing 1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage (Hologic) 1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

When more than one Presentation Context is accepted for a SOP Class, the Local DICOM Storage SCU accepts the first Presentation Context in the list returned by the SCP.

4.2.2.3.1.3 SOP Specific Conformance for all Storage SOP Classes

All Storage SOP Classes supported by Volpara SCU exhibit the same behavior, and are described together in this section.

The following table lists the possible values for the Status (0000, 0900) attribute of the C-STORE response:

Service status	error code	Reason
Success	***0000***	The DICOM instance was successfully received by the remote system.
All error codes	***A000-A7FF***	The DICOM instance was not stored. An error message is output in the service logs. A send is retried after a configurable wait period (default 900 seconds), for up to 96 times.
All warning codes	***C000-CFFF***	Transmission is considered successful.

The following table lists the behavior of Volpara SCU during communication failure:

Exception	Behavior
Timeout	The DICOM instance was not stored. An error message is output in the service logs. A send is retried after a configurable wait period (default 900 seconds), for up to 96 times.
Association aborted by the SCP or network layers	

4.2.2.3.1.4 SOP Specific Conformance for Secondary Capture Image Storage SOP Class

If configured, VolparaServer can export an SC Image instance, or “scorecard”, that displays the Volpara density results in image form (left image in Figure 3).

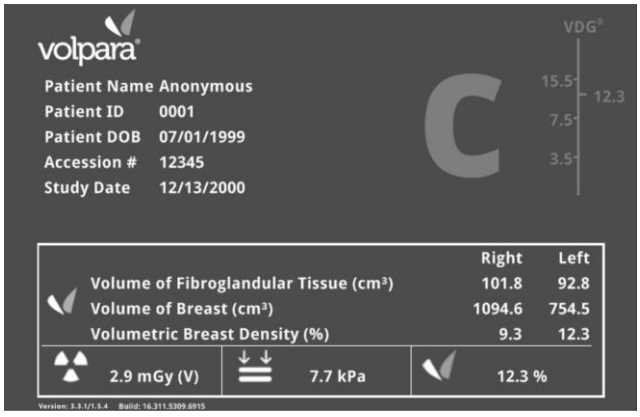

Figure 3. SC image types supported by Volpara SCU

4.2.2.4 Association Acceptance Policy

Volpara SCU does not accept associations.

4.3 Network Interfaces

4.3.1 Physical Network Interface

Volpara supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

Supported physical network interfaces
Ethernet 1000baseT
Ethernet 100baseT
Ethernet 10baseT

4.3.2 Additional Protocols

None.

4.3.3 IPv4 and IPv6 Support

VolparaServer supports only IPv4 connections.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

All local applications use the one AE Title and TCP/IP Port configured via the Volpara Dashboard User Interface.

Application Entity	Default AE title	Default TCP/IP port
Volpara SCP	VOLPARA	11112
Volpara SCU	VOLPARA	Not Applicable

4.4.1.2 Remote AE Title/Presentation Address Mapping

The AE Title, host names and port numbers of remote applications are configured using the Volpara Dashboard User Interface.

4.4.1.2.1 Remote Input Devices

The Volpara Dashboard User Interface must be used to set the AE Titles for the remote Storage SCPs. Associations will only be accepted from known AE Titles and associations from unknown AE Titles will be rejected (an AE Title is known if it can be selected within the Volpara Dashboard User Interface). Multiple remote Storage SCPs can be defined.

4.4.1.2.2 Remote Output Devices

The Volpara Dashboard User Interface must be used to set the AE Titles, port-numbers, host-names and capabilities for the remote Storage SCPs. Multiple remote Storage SCPs can be defined.

4.4.2 Parameters

A number of parameters related to acquisition and general operation can be configured using the Volpara Dashboard User Interface. The Table below only shows those configuration parameters relevant to

DICOM communication. See the VolparaServer Technical Guide for details on general configuration capabilities.

Parameter	Configurable (Yes/No)	Default value
General Parameters		
Max PDU Receive Size	Yes	16,384 bytes
Max PDU Send Size	Yes	16,384 bytes
Time-out waiting for an acceptance or rejection response to an Association Request (Application Level Timeout)	No	30 Seconds
Time-out waiting for a response to an Association release request (Application Level Timeout)	No	30 Seconds
Time-out waiting for completion of a TCP/IP connect request (Low-level timeout)	No	Unlimited
Time-out waiting for a response to a DIMSE Request (Low-Level Timeout)	No	Unlimited
Time-out waiting for data between TCP/IP-packets (Low Level Timeout)	No	300 seconds
Volpara SCP		
Listening port	Yes (“LocalPort”)	11112
AE Title	Yes (“LocalTitle”)	VOLPARA
Maximum Time for Mammo/Tomo Study	Yes	600 seconds
Maximum Time for Dose SR Study	Yes	600 seconds
Number of simultaneous Associations	Yes	6
Volpara SCU		
Sending AE Title	Yes (“LocalTitle”)	VOLPARA
Remote Hostnames or IPs	Yes (“mapping panel”)	Uses information from server configuration dashboard mapping panel
Remote Ports	Yes (“mapping panel”)	Uses information from server configuration dashboard mapping panel (default 11122)
Times between retries after send failure	Yes	900 seconds
Number or retries before abandonment	Yes	96

5 MEDIA INTERCHANGE

There is no media interchange application profile support. However, the received DICOM files and generated reports can be retained on the local file system.

6 TRANSFORMATION OF DICOM TO CDA

There is no support for HL7 CDA documents.

7 SUPPORT OF CHARACTER SETS

Volpara Server support the default character set, and the following character sets for display of Patient Name on the density scorecard;

- ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)
- ISO_IR 13, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 126, ISO_IR 127, ISO_IR 138, ISO_IR 144, ISO_IR 148, ISO_IR 166, ISO_IR 192,
- ISO 2022 IR 6, ISO 2022 IR 13, ISO 2022 IR 87, ISO 2022 IR 100, ISO 2022 IR 101, ISO 2022 IR 109, ISO 2022 IR 110, ISO 2022 IR 127, ISO 2022 IR 126, ISO 2022 IR 138, ISO 2022 IR 144, ISO 2022 IR 148, ISO 2022 IR 149, ISO 2022 IR 159, ISO 2022 IR 166
- GB18030

8 SECURITY

VolparaServer does not support DICOM security profiles.

It is assumed that VolparaServer 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 Volpara.
- Firewall or router protections to ensure that Volpara only has network access to approved external hosts and services.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels, such as a Virtual Private Network (VPN).

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

9 ANNEXES

9.1 IOD Contents

9.1.1 Created SOP Instances

The following tables use several abbreviations. The abbreviations used in the “Presence of . . .” column are as follows:

Abbreviation	Description
VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute/Module Not Always Present
ALWAYS	Always Present
EMPTY	Attribute is sent without a value

Abbreviations to be used for the “Source” column are:

Abbreviation	Description
USER	The attribute source is from user input
AUTO	The attribute value is generated automatically
FIR	The attribute source is from the first mammography image received in the study
CONFIG	The attribute value is a configurable parameter

9.1.1.1 Secondary Capture Image IOD

Table 9.1-1 Secondary Capture Image IOD module table

IE	Module	Reference	Usage	Presence of module
Patient	Patient	Table 9.1-3	M	ALWAYS
	Clinical Trial Subject		U	NOT PROVIDED
Study	General Study	Table 9.1-4	M	ALWAYS
	Patient Study	Table 9.1-5	U	ALWAYS
	Clinical Trial Study		U	NOT PROVIDED
Series	General Series	Table 9.1-10	M	ALWAYS
	Clinical Trial Series		U	NOT PROVIDED
Equipment	General Equipment	Table 9.1-6	U	ALWAYS
	SC Equipment	Table 9.1-11	M	ALWAYS
Image	General Image	Table 9.1-12	M	ALWAYS
	Image Pixel	Table 9.1-13	M	ALWAYS
	Device		U	NOT PROVIDED
	Specimen		U	NOT PROVIDED
	SC Image	Table 9.1-14	M	ALWAYS
	Overlay Plane		U	NOT PROVIDED
	Modality LUT		U	NOT PROVIDED
	VOI LUT	Table 9.1-15	U	ALWAYS
	ICC Profile		U	NOT PROVIDED
	SOP Common	Table 9.1-7	M	ALWAYS
	Common Instance Reference		U	NOT PROVIDED

9.1.1.2 Mammography CAD SR Image IOD

Table 9.1-2 Mammography CAD SR IOD module table

IE	Module	Reference	Usage	Presence of module
Patient	Patient	Table 9.1-3	M	ALWAYS
	Clinical Trial Subject		U	NOT PROVIDED
Study	General Study	Table 9.1-4	M	ALWAYS
	Patient Study	Table 9.1-5	U	ALWAYS
	Clinical Trial Study		U	NOT PROVIDED
Series	SR Document Series	Table 9.1-16	M	ALWAYS
	Clinical Trial Series		U	NOT PROVIDED
Equipment	General Equipment	Table 9.1-6	M	ALWAYS
Document	SR Document General	Table 9.1-17	M	ALWAYS
	SR Document Content	Table 9.1-18	M	ALWAYS
	SOP Common	Table 9.1-7	M	ALWAYS

9.1.1.3 Common Modules

Table 9.1-3 Patient module of all created SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Patient's Name	(0010,0010)	PN	Copied from source image	ALWAYS	FIR
Patient ID	(0010,0020)	LO	Copied from source image	ALWAYS	FIR
Patient's Birth Date	(0010,0030)	DA	Copied from source image	ALWAYS	FIR
Patient's Sex	(0010,0040)	CS	Copied from source image	ALWAYS	FIR
Any other attributes in this module, as determined on a per-SOP Class basis					FIR

Table 9.1-4 General Study module of all created SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Study Instance UID	(0020,000D)	UI	Copied from source image	ALWAYS	FIR
Study Date	(0008,0020)	DA	Copied from source image	ALWAYS (value required by Volpara)	FIR
Study Time	(0008,0030)	TM	Copied from source image	VNAP	FIR
Referring Physician's Name	(0008,0090)	PN	Copied from source image	VNAP	FIR
Study ID	(0020,0010)	SH	Copied from source image	ALWAYS (value required by Volpara)	FIR
Accession Number	(0008,0050)	SH	Copied from source image	VNAP	FIR
Study Description	(0008,1030)	LO	Copied from source image	ANAP	FIR
Physician(s) of Record	(0008,1048)	PN	Copied from source image	ANAP	FIR
Any other attributes in this module, as determined on a per-SOP Class basis					FIR

Table 9.1-5 Patient Study module of all created SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Admitting Diagnoses Description	(0008,1080)	LO	Copied from source image	ANAP	FIR
Patient's Age	(0010,1010)	AS	Copied from source image	ANAP	FIR
Patient's Size	(0010,1020)	DS	Copied from source image	ANAP	FIR
Patient's Weight	(0010,1030)	DS	Copied from source image	ANAP	FIR
Patient’s Address	(0010,1040)	LO	Copied from source image	ANAP	FIR
Occupation	(0010,2180)	SH	Copied from source image	ANAP	FIR
Additional Patient’s History	(0010,21B0)	LT	Copied from source image	ANAP	FIR
Admission ID	(0038,0010)	LO	Copied from source image	ANAP	FIR

Table 9.1-6 General Equipment module of all created SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Manufacturer	(0008,0070)	LO	“Matakina Technology”	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	Copied from source image	ANAP	AUTO
Institution Address	(0008,0081)	ST	Copied from source image	ANAP	AUTO
Station Name	(0008,1010)	SH	Windows “Computer name” assigned to VolparaServer	ALWAYS	AUTO
Institutional Department Name	(0008,1040)	LO	Copied from source image	ANAP	AUTO
Manufacturer’s Model Name	(0008,1090)	LO	“VolparaServer”	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	Network Interface ID of machine hosting VolparaServer	ALWAYS	AUTO
Software Versions	(0018,1020)	LO	Current Imaging Software version for VolparaServer	ALWAYS	AUTO

Table 9.1-7 SOP Common module of created SC image and mammography CAD SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
SOP Class UID	(0008,0016)	UI	See Section 4.2.2.1	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated automatically by the system	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 100	ANAP	FIR
Instance Creation Date	(0008,0012)	DA	Date the SR was created	ALWAYS	AUTO
Instance Creation Time	(0008,0013)	TM	Time the SR was created	ALWAYS	AUTO
VolparaServer UDI	(0015,10B0)	LO	Product UDI for VolparaServer. Volpara Private Attribute.	ALWAYS	AUTO

Table 9.1-8 Volpara Density Results macro

Attribute name	Tag	VR	Value	Presence of value	Source
Private Creator	(0015,0010)	LO	MATAKINA_10	ALWAYS	AUTO
Reported Volpara Density Grade	(0015,1028)	LO	Volpara Density Grade (VDG) reported on SC Image. Will be equal to one of (0015,102A) or (0015,1035), depending on configuration. Volpara Private Attribute.	ALWAYS	AUTO
Volpara Density Grade – 4th Edition	(0015,102A)	SH	Calculated Volpara Density Grade expressed in BIRADS 4th edition (1–4), (or a–d if this reporting option is selected for 4th edition display). Present if there are findings. Volpara Private Attribute.	ANAP	AUTO

Attribute name	Tag	VR	Value	Presence of value	Source
Volpara Reporting Edition	(0015,102C)	IS	Indicates which BIRADS edition was used in Reported Volpara Density Grade (0015,0028): 4 = 4th edition 5 = 5th edition Present if there are findings. Volpara Private Attribute.	ANAP	AUTO
Volpara Reported Density	(0015,1033)	DS	Density value reported on SC Image. Present if there are findings. Volpara Private Attribute.	ANAP	AUTO
Volpara Density Grade - 5th Edition	(0015,1035)	SH	Calculated Volpara Density Grade expressed in BIRADS 5th edition (a–d). Present if there are findings and 5th edition calculation is configured. Volpara Private Attribute.	ANAP	AUTO
Volpara Reported Density Type	(0015,1036)	CS	Type of density that was reported to user. Enumerated values: AVERAGE MAXIMUM Present if there are findings. Volpara Private Attribute.	ANAP	AUTO
Volpara Creator Full Version	(0015,1075)	LO	Full identification of software used to create the DICOM Instance (including build number).	ALWAYS	AUTO
VolparaDensity UDI	(0015,10B1)	LO	Product UDI for VolparaDensity. Volpara Private Attribute.	ALWAYS	AUTO
Volpara Image Type Values	(0015,1077)	LT	Type of images, in format “uid\side\view\type\” for each image used in the calculation (concatenated), where *side* is one of “LEFT” “RIGHT” *view* is one of “CC” “MLO” And *type* is one of “TOMO” “MAMMO” “UNKNOWN” Present if density was calculated for the images. Volpara Private Attribute.	ANAP	AUTO

Table 9.1-9 Volpara Dose RT Results macro

Attribute name	Tag	VR	Value	Presence of value	Source
Private Creator	(0015,0010)	LO	MATAKINA_10	ALWAYS	AUTO
Volpara Average Glandular Dose	(0015,1039)	DS	Patient-specific Average Glandular Dose per image in milligray (mGy), over all images used in density calculation. Calculated using Dance's method. Present if density was calculated for the images. Volpara Private Attribute.	ANAP	AUTO
Manufacturer Organ Dose	(0015,103B)	DS	Average Organ Dose per image in milligray (mGy), over all images used in density calculation. Present if density was calculated for the images. Volpara Private Attribute.	ANAP	ANAP
Reported Dose Type	(0015,103D)	CS	Type of dose that was reported to user. Enumerated values: VOLPARA MANUFACTURER Present if density was calculated for the images. Volpara Private Attribute.	ANAP	AUTO
Volpara Average Applied Pressure	(0015,1040)	DS	Average pressure in kilopascals (kPa) applied to patient anatomy for images used to calculate density. Present if Force present in images and contact area can be calculated. Volpara Private Attribute.	ANAP	AUTO
Volpara Dose RT Version Number	(0015,1051)	SH	Version number for VolparaDoseRT. Volpara Private Attribute.	ALWAYS	AUTO
Volpara DoseRT UDI	(0015,10B3)	LO	Product UDI for VolparaDoseRT. Volpara Private Attribute.	ALWAYS	AUTO
Volpara Average Applied Force	(0015,1060)	DS	Average force in Newtons (N) applied to patient anatomy for images used to calculate density. Present if Force present in images. Volpara Private Attribute.	ANAP	AUTO

9.1.1.4 Secondary Capture Modules

Table 9.1-10 General Series module of created SC image SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Modality	(0008,0060)	CS	“MG”	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated automatically by the system	ALWAYS	AUTO
Series Number	(0020,0011)	IS	Generated automatically by the system	ALWAYS	AUTO
Series Date	(0008,0021)	DA	The date at document generation	ALWAYS	AUTO
Series Time	(0008,0031)	TM	The time at document generation	ALWAYS	AUTO
Series Description	(0008,103E)	LO	“Mammography density Secondary Capture Series”	ALWAYS	AUTO
Body Part Examined	(0018,0015)	CS	“BREAST”	ALWAYS	AUTO

Table 9.1-11 SC Equipment module of created SC image SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Conversion Type	(0008,0064)	CS	“WSD”	ALWAYS	AUTO
Modality	(0008,0060)	CS	“MG”	ALWAYS	AUTO

Table 9.1-12 General Image module of created SC image SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Instance Number	(0020,0013)	IS	“1”	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS	Zero length	ALWAYS	AUTO
Content Date	(0008,0023)	DA	The date of document generation	ALWAYS	AUTO
Content Time	(0008,0033)	TM	The time of document generation	ALWAYS	AUTO
Image Type	(0008,0008)	CS	“ORIGINAL\SECONDARY”	ALWAYS	AUTO
Burned in Annotation	(0028,0301)	CS	“YES”	ALWAYS	AUTO
Referenced Image Sequence	(0008,1140)	SQ	The set of mammography images contributing to the density result	ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	SOP Class UID of contributing instance (raw mammography or Hologic SC Image)	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	SOP Instance UID of contributing instance	ALWAYS	AUTO
Recognizable Visual Features	(0028,0302)	CS	“NO”	ALWAYS	AUTO
Icon Image Sequence	(0088,0200)	SQ	Icon representation of the Volpara Density result	ALWAYS	AUTO
>Samples per Pixel	(0028,0002)	US	1	ALWAYS	AUTO
>Photometric Interpretation	(0028,0004)	CS	MONOCHROME2	ALWAYS	AUTO
>Rows	(0028,0010)	US	64	ALWAYS	AUTO
>Columns	(0028,0011)	US	64	ALWAYS	AUTO
>Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
>Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
>High Bit	(0028,0102)	US	7	ALWAYS	AUTO
>Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
>Pixel Data	(7fe0,0010)	OW	Pixel data for icon image (“scorecard” image only)	ALWAYS	AUTO

Table 9.1-13 Image Pixel module of created SC image SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Samples per Pixel	(0028,0002)	US	For RGB images: “3” For MONOCHROME2 images: 1	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	“RGB” or "MONOCHROME2"	ALWAYS	AUTO
Rows	(0028,0010)	US	480 minimum (more if additional outputs are configured for display)	ALWAYS	AUTO
Columns	(0028,0011)	US	750	ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO
High Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB	Image generated by software. See Figure 3.	ALWAYS	AUTO
Planar Configuration	(0028,0006)	US	0	ALWAYS for RGB NOT PROVIDED for MONOCHROME2	AUTO
SC Image Density Scorecards only*: If VolparaDensity is licensed, include Table 9.1-8, “Volpara Density Results Macro”.*					
SC Image Density Scorecards only*: If VolparaDoseRT is licensed, include Table 9.1-9 “Volpara Dose RT Results Macro”.*					

Table 9.1-14 SC Image module of created SC image SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
No attributes provided from this module.					

Table 9.1-15 VOI LUT module of created SC image SOP instances (MONOCHROME2 only)

Attribute name	Tag	VR	Value	Presence of value	Source
Window Center	(0028,1050)	DS	“128” (MONOCHROME2 only)	ALWAYS	AUTO
Window Width	(0028,1051)	DS	“256” (MONOCHROME2 only)	ALWAYS	AUTO

9.1.1.5 Mammography CAD SR Modules

Table 9.1-16 SR Document Series module of created mammography CAD SR SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Modality	(0008,0060)	CS	“SR”	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Generated automatically by the system	ALWAYS	AUTO
Series Number	(0020,0011)	IS	“1”	ALWAYS	AUTO
Series Date	(0008,0021)	DA	The date at document generation	ALWAYS	AUTO
Series Time	(0008,0031)	TM	The time at document generation	ALWAYS	AUTO
Series Description	(0008,103E)	LO	“Mammography density SR Series”	ALWAYS	AUTO
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	Zero Length	ALWAYS	AUTO

Table 9.1-17 SR Document General module of created mammography CAD SR SOP instances

Attribute name	Tag	VR	Value	Presence of value	Source
Instance Number	(0020,0013)	IS	“1”	ALWAYS	AUTO
Preliminary Flag	(0040,A496)	CS	“FINAL”	ALWAYS	AUTO
Completion Flag	(0040,A491)	CS	“COMPLETE”	ALWAYS	AUTO
Verification Flag	(0040,A493)	CS	“UNVERIFIED”	ALWAYS	AUTO
Content Date	(0008,0023)	DA	The date of document generation	ALWAYS	AUTO
Content Time	(0008,0033)	TM	The time of document generation	ALWAYS	AUTO
Performed Procedure Code Sequence	(0040,A372)	SQ	Zero length	ALWAYS	AUTO
Current Requested Procedure Evidence Sequence	(0040,A375)	SQ	Contains references to Series and Images used for the density calculation.	ALWAYS	AUTO
If VolparaDensity is licensed: Include Table 9.1-8, “Volpara Density Results Macro”.					
If VolparaDoseRT is licensed: Include Table 9.1-9 “Volpara Dose RT Results Macro”.					

Table 9.1-18 SR Document Content module of created mammography CAD SR SOP instances

Attribute name	Tag	Req Type	Value	Presence of value	Source
Value Type	(0040,A040)		“CONTAINER”	ALWAYS	AUTO
Concept Name Code Sequence	(0040,A043)	1C	One sequence item - identifies the report type	ALWAYS	AUTO
>Code Value	(0008,0100)	1	“111036”	ALWAYS	AUTO
>Coding Scheme Designator	(0008,0102)	1	“DCM”	ALWAYS	AUTO
>Code Meaning	(0008,0104)	1	“Mammography CAD Report”	ALWAYS	AUTO
Continuity of Content	(0040,A050)	1	“SEPARATE”	ALWAYS	AUTO
Content Template Sequence	(0040,A504)	1C	One sequence item - identifies the root template	ALWAYS	AUTO
>Mapping Resource	(0008,0105)	1	“DCMR”	ALWAYS	AUTO
>Template Identifier	(0040,DB00)	1	“4000”	ALWAYS	AUTO
Content Sequence	(0040,A730)	1C	Sequence contains multiple Items according to TID 4000.	ALWAYS	AUTO
(Items)			Include Items for TID 4000 “Mammography CAD Document Root”. See Figure 4 and Table 9.1-19.	ALWAYS	AUTO

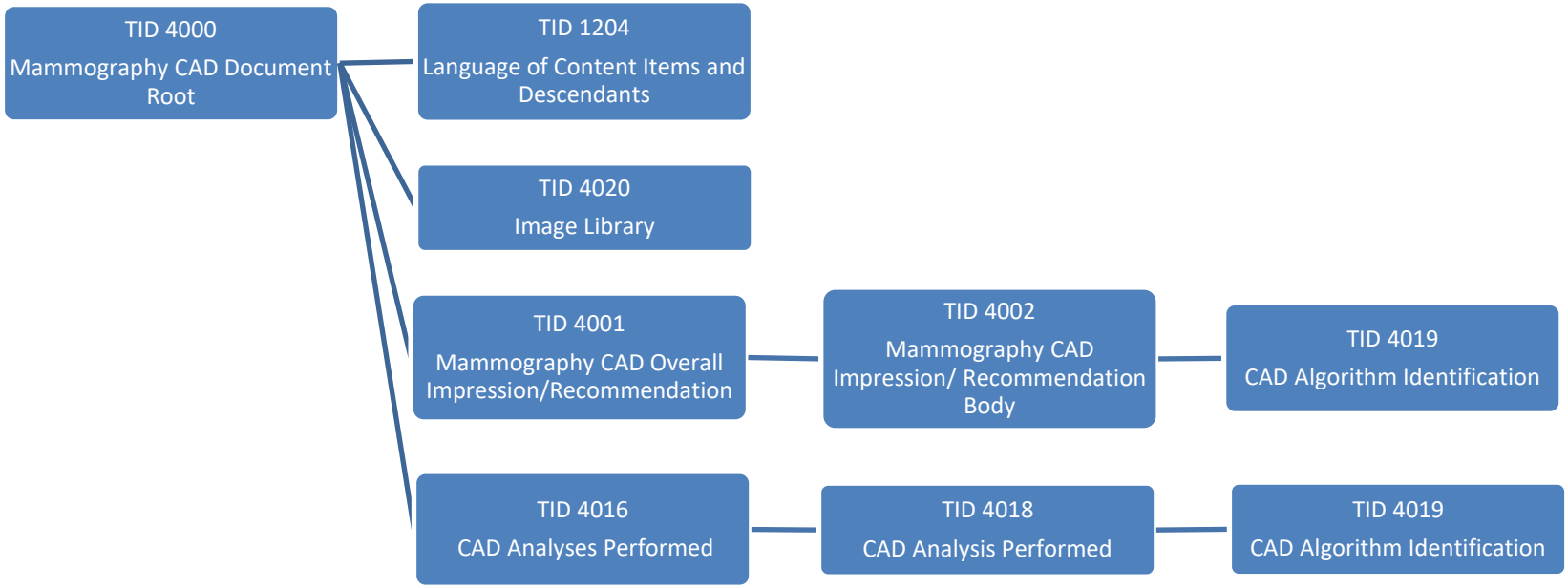

Figure 4. Mammography CAD SR structure

Table 9.1-19 Mammography CAD document root (TID 4000)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			CONTAINER	M	EV (111036, DCM, “Mammography CAD Report”)	-	ALWAYS
2	>	HAS CONCEPT MOD	INCLUDE	M	DTID 1204 “Language of Content Item and Descendants”	Refer Table 9.1-20	ALWAYS
3	>	CONTAINS	CONTAINER	M	EV (111028, DCM, “Image Library”)	-	ALWAYS
4	>>	CONTAINS	INCLUDE	M	DTID 4020 “CAD Image Library Entry”	Refer to Table 9.1-25	ALWAYS
5	>	CONTAINS	INCLUDE	M	DTID 4001 “Mammography CAD Overall Impression/Recommendation”	Refer to Table 9.1-21	
6	>	CONTAINS	CODE	M	EV (111064, DCM, “Summary of Detections”)	111225, DCM, “Not Attempted”	ALWAYS
8	>	CONTAINS	CODE	M	EV (111065, DCM, “Summary of Analyses”)	One of the following: 111222, DCM, “Succeeded” if a VDG density score was generated by Volpara, and all images yielded a density result. 111223, DCM, “Partially Succeeded” if a VDG density score was generated by Volpara, and one or more images did not yield a density result. 111224, DCM, “Failed” if a VDG density score was NOT generated by Volpara.	ALWAYS
9	>>	INFERRED FROM	INCLUDE	M	DTID 4016 “CAD Analyses Performed”	Refer to Table 9.1-22	ALWAYS

Table 9.1-20 Language of content and descendants (DTID 1204)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1		HAS CONCEPT MOD	CODE	M	EV (121049, DCM, “Language of Content Item and Descendants”)	(en, RFC3066, “English”)	ALWAYS
2	>	HAS CONCEPT MOD	CODE	U	EV (121046, DCM, “Country of Language”)	(US, ISO3166_1, “UNITED STATES”)	ALWAYS

Table 9.1-21 Mammography overall CAD impression/recommendation (DTID 4001)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			CODE	M	EV (111017, DCM, “CAD Processing and Findings Summary”) EV (111017, DCM, “CAD Processing and Findings Summary”)	One of: 111242, DCM, “All algorithms succeeded; with findings” if a VDG score was generated 111244, DCM, “Not all algorithms succeeded; with findings” if a VDG was generated, but one or more images failed to yield a result. 111245, DCM, “Not algorithms succeeded; without findings” if a VDG was not generated (a “null report”)	ALWAYS
2	>	HAS PROPERTIES	INCLUDE	U	DTID 4002 Mammography CAD Impression/ Recommendation Body	Refer to Table 9.1-26	ANAP

Table 9.1-22 CAD analyses performed (TID 4016)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			CONTAINER	MC	EV (111062, DCM, “Successful Analyses”)	-	ANAP (present if value of parent is (111222, DCM, “Succeeded”)
2	>	CONTAINS	INCLUDE	M	DTID 4018 “CAD Analysis Performed”	Refer to Table 9.1-23	ALWAYS
3			CONTAINER	MC	EV (111024, DCM, “Failed Analyses”)	-	ANAP (present if value of parent is (111224, DCM, “Failed”)
4	>	CONTAINS	INCLUDE	M	DTID 4018 “CAD Analysis Performed”	Refer to Table 9.1-23	ALWAYS

Table 9.1-23 CAD analysis performed (TID 4018)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			CODE	M	EV (111004, DCM, “Analysis Performed”)	P5-B3414,SRT, “Breast composition analysis”	ALWAYS
2	>	HAS PROPERTIES	INCLUDE	M	DTID 4019 CAD Algorithm Identification	Refer to Table 9.1-24	ALWAYS
4	>	R-HAS PROPERTIES	IMAGE	MC		Reference to an IMAGE content item in the “Image Library” based on its node position. Repeat for every image the algorithm has processed.	ALWAYS

Table 9.1-24 CAD algorithm identification (TID 4019)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			TEXT	M	EV (111001, DCM, “Algorithm Name”)	“Volpara”	ALWAYS
2			TEXT	M	EV (111003, DCM, “Algorithm Version”)	Algorithm Version	ALWAYS

Table 9.1-25 CAD image library entry (TID 4020)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
1			IMAGE	M		Referenced SOP Sequence containing the SOP Class UID and SOP Instance UID copied from the source image header	ALWAYS
2	>	HAS ACQ CONTEXT	CODE	MC	EV (111027, DCM, “Image Laterality”)	If Right Breast: T-04020, SRT, “Right breast” If Left Breast: T-04030, SRT, “Left breast”	ALWAYS
3	>	HAS ACQ CONTEXT	CODE	MC	EV (111031, DCM, “Image View”)	Copied from source image View Code Sequence	ALWAYS
4	>>	HAS CONCEPT MOD	CODE	MC	EV (111032, DCM, “Image View Modifier”)	Copied from source image View Modifier Code Sequence	ANAP
5	>	HAS ACQ CONTEXT	TEXT	MC	EV (111044, DCM, “Patient Orientation Row”)	Copied from source image (0020,0020) attribute value 1	ALWAYS
6	>	HAS ACQ CONTEXT	TEXT	MC	EV (111043, DCM, “Patient Orientation Column”)	Copied from source image (0020,0020) attribute value 2	ALWAYS
7	>	HAS ACQ CONTEXT	DATE	MC	EV (111060, DCM, “Study Date”)	Copied from source image Study Date (0008,0020) attribute value	ALWAYS
8	>	HAS ACQ CONTEXT	TIME	MC	EV (111061, DCM, “Study Time”)	Copied from source image Study Time (0008 0030) if value is not empty	ANAP
9	>	HAS ACQ CONTEXT	DATE	MC	EV (111018, DCM, “Content Date”)	Copied from source image Content Date (0008,0023) if value is not empty	ANAP

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
10	>	HAS ACQ CONTEXT	TIME	MC	EV (111019, DCM, “Content Time”)	Copied from source image Study Time (0008,0033) if value is not empty	ANAP
11	>	HAS ACQ CONTEXT	NUM	MC	EV (111026, DCM, “Horizontal Pixel Spacing”)	Converted from source image header (0018,1164) attribute value 1. UNITS = (mm, UCUM, “millimeter”)	ANAP
12	>	HAS ACQ CONTEXT	NUM	MC	EV (111066, DCM, “Vertical Pixel Spacing”)	Converted from source image header (0018, 1164) attribute value 2. UNITS = (mm, UCUM, “millimeter”)	ANAP
13	>	HAS ACQ CONTEXT	NUM	UC	EV (112011, DCM, “Positioner Primary Angle”)	Copied from source image (0018,1510) Assumes UNITS = (deg, UCUM, “o”)	ANAP
14	>	HAS ACQ CONTEXT	NUM	UC	EV (112012, DCM, “Positioner Secondary Angle”)	Copied from source image (0018,1511) Assumes UNITS = (deg, UCUM, “o”)	ANAP

Table 9.1-26 Mammography CAD impression/recommendation body (TID 4002)

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
5			TEXT	MC	EV (111033, DCM, “Impression Description”)	“Volpara breast density findings”	ALWAYS
11			INCLUDE	M	DTID 4019 CAD Algorithm Identification	Refer to Table 9.1-24	ALWAYS
Left breast results							
12			NUM	U	DCID 6142 Calculated Value	(112193, DCM, “Volume of breast”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04030, SRT, “Left breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
12			NUM	U	DCID 6142 Calculated Value	(112192, DCM, “Volume of parenchymal tissue”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04030, SRT, “Left breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
12			NUM	U	DCID 6142 Calculated Value	(112191, DCM, “Breast tissue density”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04030, SRT, “Left breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
Right breast results							
12			NUM	U	DCID 6142 Calculated Value	(112193, DCM, “Volume of breast”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04020, SRT, “Right breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
12			NUM	U	DCID 6142 Calculated Value	(112192, DCM, “Volume of parenchymal tissue”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04020, SRT, “Right breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
12			NUM	U	DCID 6142 Calculated Value	(112191, DCM, “Breast tissue density”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	U	EV (G-C171, SRT, “Laterality”)	(T-04020, SRT, “Right breast”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	M	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
Bilateral results							
12			NUM	U	DCID 6142 Calculated Value	(112191, DCM, “Breast tissue density”) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	-	EV (G-C171, SRT, “Laterality”)	(T-04080, SRT, “Both breasts”)	ALWAYS

	NL	Rel with Parent	VT	Req Type	Concept name	Value	Presence of value
14	>	HAS CONCEPT MOD	CODE	-	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
15	>	HAS CONCEPT MOD	TEXT	-	EV (112034, DCM, “Calculation Description”)	“AVERAGE” or “MAXIMUM”, as reported in (0015,1036) Volpara Reported Density Type (see Table 9.1-8)	ALWAYS
Bilateral results—standard extended attributes							
12			CODE	-	EV (F-01710, SRT, “Breast composition”)	See DCID 6000 (DCID 6001) Overall Breast Composition. Values are: (F-01711,SRT,Almost entirely fat) (F-01712,SRT, Scattered fibroglandular densities) (F-01713,SRT, Heterogeneously dense) (F-01714,SRT, Extremely dense) Present if 111017 (in TID 4000) is 111242 or 111244.	ANAP
13	>	HAS CONCEPT MOD	CODE	-	EV (G-C171, SRT, “Laterality”)	(T-04080, SRT, “Both breasts”)	ALWAYS
14	>	HAS CONCEPT MOD	CODE	-	EV (121401, DCM, “Derivation”)	(112189, DCM, “Three-dimensional method”)	ALWAYS
15	>	HAS CONCEPT MOD	TEXT	-	EV (112034, DCM, “Calculation Description”)	“AVERAGE” or “MAXIMUM”, as reported in (0015,1036) Volpara Reported Density Type (see Table 9.1-8)	ALWAYS

9.1.2 Usage of Attributes from Received IODs

9.1.2.1 Attributes and Values Required for All Images

The following attributes and values are required to be present with values as described, in order for processing by Volpara Algorithm to take place.

Table 9.1-27 Attributes Volpara requires in all mammography images

Tag	Type	Description	Constraint
(0008,0020)	2	Study Date	If not valid: error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0008,0023)	2C	Content Date	If not valid: error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0008,0030)	2	Study Time	If not valid: error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0008,0060)	1	Modality	If not equal to “MG”: error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0008,0070)	2	Manufacturer	If ([manufacturer], [model]) combination is not one of the following: error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR. Note: Additional scanners may be validated on a case-by-case basis: ([*], [Senograph, ADS, HOLOGIC, LORAD, Mammo-Clinical, BRESTIGE]) ([GE MEDICAL, HOLOGIC, LORAD, MEDI_FUTURE, MediFuture], [*]) ([GE HEALTHCARE], [Pristina]) ([FUJI], [AMULET, ASPIRE, FDR-1000AWS, FDR-2000AWS, FDR-3000AWS, Clearview, CR-IR363AWS]) ([Planmed, Anrad], [Nuance, SMAMII]) ([Sectra, Philips], [L30, L50, MDM 1.5]) ([Philips], [Philips, MammoDiagnost]) ([SIEMENS], [Novation, Inspiration]) ([SIEMENS], [*]) where (0008,0008) contains “TOMO_PROJ” ([MetalTronica], [Helianthus, Helantius]) ([IMS], [Giotto]) ([TMM], [MGU-1000D])
(0008,1090)	3	Manufacturer’s Model Name	
(0008,0068)	1	Presentation Intent Type	If not equal to “FOR PROCESSING” for mammo images: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.

Tag	Type	Description	Constraint
(0010,0010)	2	Patient's Name	If not present and valid: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0010,0020)	2C	Patient ID	If not present and valid: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0010,0030)	2	Patient's Birth Date	If not present and valid: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0010,0040)	2	Patient's Sex	Image rejected if absent or not equal to "F". A null value is permitted by default.
(0018,0015)	3	Body Part Examined	If not equal to "BREAST": Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0018,0060)	1	KVP	Required for Volpara density calculations.
(0018,1114)	3	Estimated Radiographic Magnification Factor	If present and greater than a configured value (default range 0 < x <= 1.1): Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0018,1164)	1 or 3	Imager Pixel Spacing	If missing or 0, and then Detector Element Spacing (0018,7022) is missing, and then Pixel Spacing (0028,0030) is missing: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0018,11A0)	1	Body Part Thickness	Required for density calculation.
(0018,1191)	3	Anode Target Material	Volpara will only produce a density for Target/Filter combinations of: Mo/Mo, Mo/Rh, Mo/W, Mo/Al, Mo/Ag, Rh/Mo, Rh/Rh, Rh/W, Rh/Al, Rh/Ag, W/Rh, W/W, W/Al, and W/Ag
(0018,7050)	3	Filter Material	
(0018,7052) (0018,7054)	3	Filter Thickness Minimum Filter Thickness Maximum	One or both of these values is highly recommended. If absent, Volpara will use a default.
(0018,7022)	3	Detector Element Spacing	See Imager Pixel Spacing (0018,1164)
(0018,9328)	1C	Exposure Time in ms	Either (0018,9332) or both (0018,9330) and (0018,9332) are required for Volpara Density scatter calculations.
(0018,9330)	1C	X-ray Tube Current in mA	
(0018,9332)	1C	Exposure in mAs	
(0020,0010)	2	Study ID	If zero-length: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.

Tag	Type	Description	Constraint
(0020,0020)	1	Patient Orientation	If 1st value is not one of “A” or “P” and 2nd value is not one of “L”,”F”,”R”, “FL”, “FR”, or “HL”: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0020,0060)	1	Laterality	See Image Laterality (0020,0062)
(0020,0062)		Image Laterality	If not equal to “L” or “R” and Laterality (0020,0060) is missing or invalid: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0028,0030)	1	Pixel Spacing	See Imager Pixel Spacing (0018,1164)
(0028,0010) (0028,0011) (0028,0100) (0028,0101) (0028,0102) (0028,0004)	1	Rows, Columns, Bits Allocated, Bits Stored, High Bit, Photometric Interpretation	These Type 1 Image Module attributes are required for correct processing of the image pixels.
(0028,1300)	1C	Breast Implant Present	If equals to “YES” and View Modifier Code Sequence (0054,0222) is not present or does not contain a Value of “R-102D5”: Error reported in logs, image referenced as unused in Mammo CAD SR, and Dose SR.
(0054,0220)	1	View Code Sequence	If Code Value if not equal to “R-10226” (MLO) or “R-10242” (CC) for mammography images
(0054,0222)	2C	View Modifier Code Sequence	See Breast Implant Present (0028,1300)
Volpara also examines the image to determine the location of the chest wall and breast edge, and rejects the image if this does not conform to the expected orientation.			

9.1.2.2 Manufacturer-specific Requirements

The following attributes and values are required to be present for specific manufacturer and image types, in order for processing by Volpara Algorithm to take place.

Table 9.1-28 Manufacturer-specific attributes Volpara requires in mammography images

Tag	Name	Description
Hologic/LORAD		
(0019,xx26)	Hologic Paddle ID Description	Required by Volpara algorithm. Images having values of “10CMC”, or “7.5CMC” are not processed.
(7e01,xx02)	Hologic Codec Content Type	Used to determine if the image is a raw tomosynthesis image. Images having a value not equal to “HLXR” are not processed.
Fuji		
(0018,6000)	Sensitivity	
(0025,xx13)	Latitude	Fuji private attribute

9.1.2.3 Attributes Used by Volpara Dose SR and Volpara Dose RT

Table 9.1-29 Additional attributes used by VolparaDose

Tag	Name	Description
(0040,0314)	Half Value Layer	Required by Volpara algorithm for Volpara Dose to be calculated (not required in image if supplied in a dose calibration file).
(0040,8302)	Entrance Dose in mGy	Required by Volpara algorithm for Volpara Dose to be calculated (not required in image if supplied in a dose calibration file or for Fuji CR systems).

9.1.2.4 Attributes Used by VolparaEnterprise Analytics

A number of attributes are not required by VolparaServer, but if present will be used by VolparaEnterprise Analytics.

Table 9.1-30 Additional attributes used by VolparaEnterprise Analytics

Tag	Usage
(0008,0090) Referring Physician Name	Display studies grouped by referring physician
(0010,0200) Quality Control Subject	For future use
(0018,1000) Device Serial Number	One or more values used in combination to identify unique mammography machines
(0018,1010) Station Name	
(0018,700a) Detector ID	
(0018,1008) Gantry ID	
(0018,7001) Detector Temperature	Reported in Analytics

Tag	Usage
(0018,1152) Exposure	Used in combination to report exposure
(0018,1150) Exposure Time	
(0018,1151) X-Ray Tube Current	
(0008,1070) Operator's Name	Used to sort studies by Operator and yield Operator-specific statistics
(0018,1200) Date of Last Calibration	For future use
(0018,700c) Date of Last Detector Calibration	For future use
(0008,0022) Acquisition Date	One or other used to report on time between studies
(0008,0032) Acquisition Time	
(0008,0022) Content Date	
(0008,0032) Content Time	
(0028,0300) Quality Control Image	For future use
(0040,0314) Half Value Layer	Reported in Analytics
(0050,0004) Calibration Image	For future use
Reason for Study (VolparaEnterprise Analytics can also be configured to detect strings other than 'screening' and 'diagnostic')	
Request Attributes Sequence (0040,0275), attribute (0040,0008) (Scheduled Protocol Code Sequence)	If Code Meaning (008,0104) contains "screening" or "diagnostic" (ignoring case), this shall be used, otherwise see below.
Request Attributes Sequence (0040,0275), attribute (0040,100a) (Reason for Requested Procedure Code Sequence)	If Code Value (0008,0100) is "R-42453" (screening) or "R-408C3" (diagnostic), this shall be used, otherwise see below.
Request Attributes Sequence (0040,0275), attribute (0032,1060) (Requested Procedure Description)	If this attribute contains "screening" or "diagnostic" (ignoring case), this shall be used, otherwise see below.
Request Attributes Sequence (0040,0275), attribute (0040,0007) (Scheduled Procedure Step Description)	If this attribute contains "screening" or "diagnostic" (ignoring case), this shall be used, otherwise see below.
Performed Protocol Code Sequence (0040,0260)	If Code Meaning (008,0104) contains "screening" or "diagnostic" (ignoring case), this shall be used, otherwise see below.
Reason for Requested Procedure Code Sequence (0040,100a)	If Code Value (0008,0100) is "R-42453" (screening) or "R-408C3" (diagnostic), this shall be used, otherwise see below.
Reason for Performed Procedure Code Sequence (0040,1012)	If Code Value (0008,0100) is "R-42453" (screening) or "R-408C3" (diagnostic), this shall be used, otherwise see below.
Reason for Study (retired) (0032,1030)	If this attribute contains "screening" or "diagnostic" (ignoring case), this shall be used, otherwise see below. Found in older Hologic images.

Tag	Usage
Protocol Name (0018,1030)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Requested Procedure Description (0032,1060)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Performed Procedure Step Description (0040,0254)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Scheduled Procedure Step Description (0040,0007)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Admitting Diagnoses Description (0008,1080)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Series Description (0008,103E)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used, otherwise see below.
Study Description (0008,1030)	If this attribute contains “screening” or “diagnostic” (ignoring case), this shall be used.

9.1.3 Attribute Mapping

Various attributes are used in Secondary Capture, Mammography CAD SR, and X-ray Radiation Dose SR. Refer to Created SOP Instances. See Section 9.1.1 for more information.

9.1.4 Coerced/Modified Attributes

None.

9.2 Data Dictionary of Private Attributes

The following private attributes are defined for Volpara:

Name	Tag	VR	VM	Notes
MATAKINA_10	(0015,0010)	LO	1	Private Data Element Creator
Reported Volpara Density Grade	(0015,1028)	LO	1	
Volpara Density Grade – 4th Edition	(0015,102A)	SH	1	
Volpara Density Grade – 5th Edition	(0015,102B)	SH	1	
Volpara Reporting Edition	(0015,102C)	IS	1	
Volpara Reported Density	(0015,1033)	DS	1	
Volpara Density Grade - 5th Edition	(0015,1035)	SH	1	
Volpara Average Glandular Dose	(0015,1039)	DS	1	
Manufacturer Organ Dose	(0015,103B)	DS	1	
Reported Dose Type	(0015,103D)	CS	1	
Volpara Average Applied Pressure	(0015,1040)	DS	1	
Volpara Dose RT Version Number	(0015,1051)	SH	1	
Volpara Average Applied Force	(0015,1060)	DS	1	
Volpara Creator Full Version	(0015,1075)	LO	1	
Volpara Image Type Values	(0015,1077)	LT	1	
VolparaServer UDI	(0015,10B0)	LO	1	
VolparaDensity UDI	(0015,10B1)	LO	1	
VolparaDoseRT UDI	(0015,10B3)	LO	1	

9.3 Coded Terminology and Templates

9.3.1 Context Groups

Created Mammography CAD SR SOP Instances use the context groups that are associated with DICOM TID 4000 and related templates. Created X-Ray Radiation Dose SR SOP Instances use the context groups that are associated with DICOM TID 10002, DICOM TID 10005, and related templates.

9.3.2 Template Specifications

9.3.2.1 Mammography CAD SR

Created Mammography CAD SR SOP Instances use DICOM TID 4000 and related templates. An extension is used to report the overall VDG (BIRADS) score. This extension is described in Table 9.1-26 lines 15-18. Additional information related to density reporting is also provided in Table 9.1-8 (Volpara Density Results Macro).

9.3.3 Private Code Definitions

None.

9.4 Grayscale Image Consistency

Not applicable.

9.5 Standard Extended/Specialized/Private SOP Classes

None.

9.6 Private Transfer Syntaxes

None.

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