

# Internal Use Only

**Siemens Medical Solutions USA, Inc., Ultrasound Group**

## **SONOLINE Antares Product Platform DICOM Conformance Statement**

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Revision: 02

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## 1.0 Purpose

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard by the SONOLINE<sup>®</sup> Antares ultrasound system software version 1.1 from Siemens Medical Systems, Inc. Ultrasound Group. It shall establish the conformance specifications for this system only, and does not apply to other products offered by Siemens Medical Systems, or its affiliates.

The SONOLINE Antares system is a device that generates ultrasound images that can be sent using DICOM standard protocols and definitions to other DICOM compliant devices including any DICOM compliant devices that support SOP classes as defined in Table 4.

## 1.1 Scope

The DICOM standard provides a well-defined set of structures and protocols that allow interoperability of a wide variety of medical imaging devices.

When configured with the DICOM option, the SONOLINE Antares system provides support for essential services related to ultrasound scanning and connectivity to DICOM compliant devices. SONOLINE Antares system products will not support all features supported by the DICOM standard. This document clearly states the DICOM services and data classes that are supported by the applications included with the SONOLINE Antares. The intent of this document is to allow users and other vendors who also conform to the DICOM standard to exchange information within the specific context of those elements of the DICOM standard that SONOLINE Antares system supports.

This document is written with respect to the adopted portions of the DICOM standard, Revision 3. The following sections of this document follow the outline specified in the DICOM Standard NEMA publication PS3.2 [1].

## 2.0 References

Specifications of the DICOM 3.0 standard may be obtained from ACR-NEMA for customers who require detailed information.

**Table 1: References**

Document Title	Location
[1] Second part of the DICOM standard: NEMA Standards Publication PS 3.2-1998, Digital Imaging and Communications in Medicine (DICOM), Part 2: Conformance	

## 3.0 Definitions

**Table 2: Acronyms and Abbreviations**

<b>Acronym or Abbreviation</b>	<b>Definition</b>
ACR-NEMA	American College of Radiology - National Electrical Manufacturer's Association
AE	Application Entity
Conformance Statement	A formal statement associated with a specific implementation of the DICOM Standard. It specifies the Service Classes, Information Objects, Communications Protocols and Media Storage Application Profiles supported by the implementation
DICOM 3.0	Digital Imaging and Communications in Medicine, Version 3.0.
DIMSE	DICOM Message Service Element
DIMSE C-STORE	DICOM Message Service Element, Composite Store
Ethernet	Network methodology devised in 1976 by DIX (DEC/Intel/Xerox) which is the most common in practice today.
IOD	Information Object Definition
MWL	Modality Worklist
OOG	Object Oriented Graphics
PACS	Picture Archiving and Communications Systems
PDU	Protocol Data Unit
RWA	Real-World Activity
SCP	Service Class Provider
Syngo	Siemens Common User SW –Common User Interface
SCU	Service Class User
SOP	Service-Object Pairs
UID	Unique identifier

### 3.1 Support of Extended Character Sets

The Antares supports the “ISO-IR 100” Latin alphabet 1 Extended character set.

## 4.0 Implementation Model

SONOLINE Antares system users can store images directly on the system hard disk. Images can be exported to a DICOM archive server or workstation on a network. The user is capable of querying a DICOM Worklist server for a list of scheduled patient procedures. SONOLINE Antares system real world activities are indicated by “Real World Activity” name while “Antares AE” indicates the invoked Application Entity. Similarly, the activities associated with service providers are indicated as “Real World Service Activity.”

### 4.1 Application Data Flow Diagram

Figure 5 on page 11 illustrates the SONOLINE Antares system’s Application Entity (AE), which is shown in the box. Relationships between users invoked activities (in the circles at the left of the AE) and the associated real-world activities provided by DICOM service providers (in the circles on the right side of the diagram) are shown.

The user selects “Patient” at the start of each new patient examination.

Selecting either “End Exam” or “New Patient” ends the previous exam. When an “End Exam” message is presented to the Antares AE all associations to open DICOM open devices are closed.

#### 4.1.1 Verification

Verification is available through the Service configuration UI located on the OEM Filming page of the System Presets. Verification can be used to send a DICOM verification request to a remote Application Entity (AE) and will listen for a response. When used as a diagnostic tool, Verification will return the following messages to the user:

- Application Entity Title “AE Name” is responding.
- Application Entity Title “AE Name” is not responding.

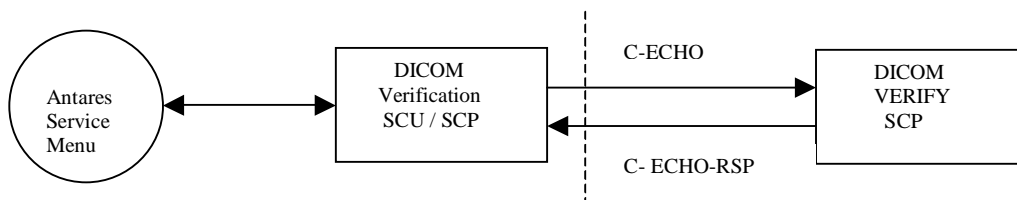


Figure 1: Verification Model

### 4.1.2 Store to Disk

To invoke the DICOM Store, the user selects the “Store to Disk” button

(A SONOLINE Antares system Real World Activity) during a patient exam, causing the image currently displayed on the system monitor screen to be captured to hard disk. Captured images stored to disk can be transferred to a remote destination via the “Patient Browser” screen.

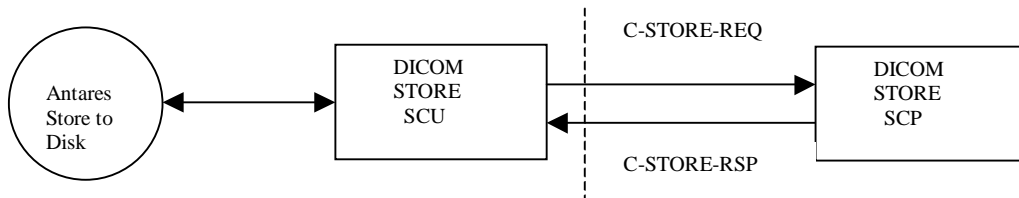


Figure 2: Store Model

### 4.1.3 Print 1 and Print 2

The user assigns the desired network grayscale or color printer server using the “Filming/OEM” Presets function. In Presets, a desired printer is assigned to either the “PRINT 1” or “PRINT 2” icon. The Presets function is also used to define the configuration of the DICOM Print Service Provider. Image format on the hardcopy devices is determined from the format described in the “Filming/OEM” Presets function.

To invoke the Print” REAL WORLD ACTIVITY,” the user selects the “PRINT 1” or “PRINT 2” icons. Print images can be sent immediately after the “Print” hard key is pressed, or queued to hard disk for transfer later.

### 4.1.4 Expose Film Job

After an image exam is complete, the user has the ability to Print images stored on the hard drive using the Filming UI. Invoking the “Expose Film Job” Real World activity invokes the DICOM Print activity for selected exams or individual images. “Expose Film Job” is available through the Filming UI function. The Antares system is capable of grayscale and color images.

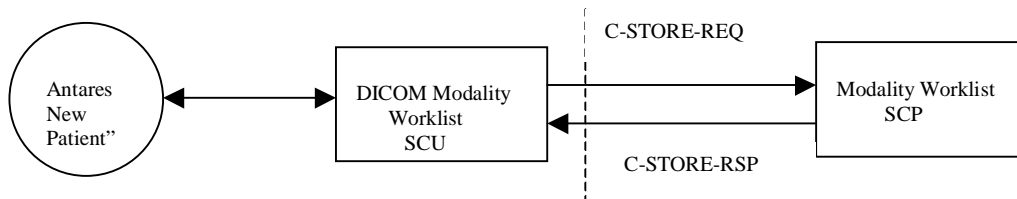
Figure 3: Print Model

### 4.1.5 New Patient

Patient registration can be automated by using the ‘Worklist’ Real World Activity.

Double clicking the ‘Scheduler’ icon in the patient browser UI initiates the query for all scheduled ultrasound patients for ‘today.’ If no matches are found, a message will be presented to the operator indicating so. If more that one patient is found, a pick list of patient exams will be presented to the user to select from.

Selection of a patient from the list will cause all demographic information for that patient to be loaded in to the patient data fields in the Patient Registration screen.



**Figure 4: Modality Worklist Model**

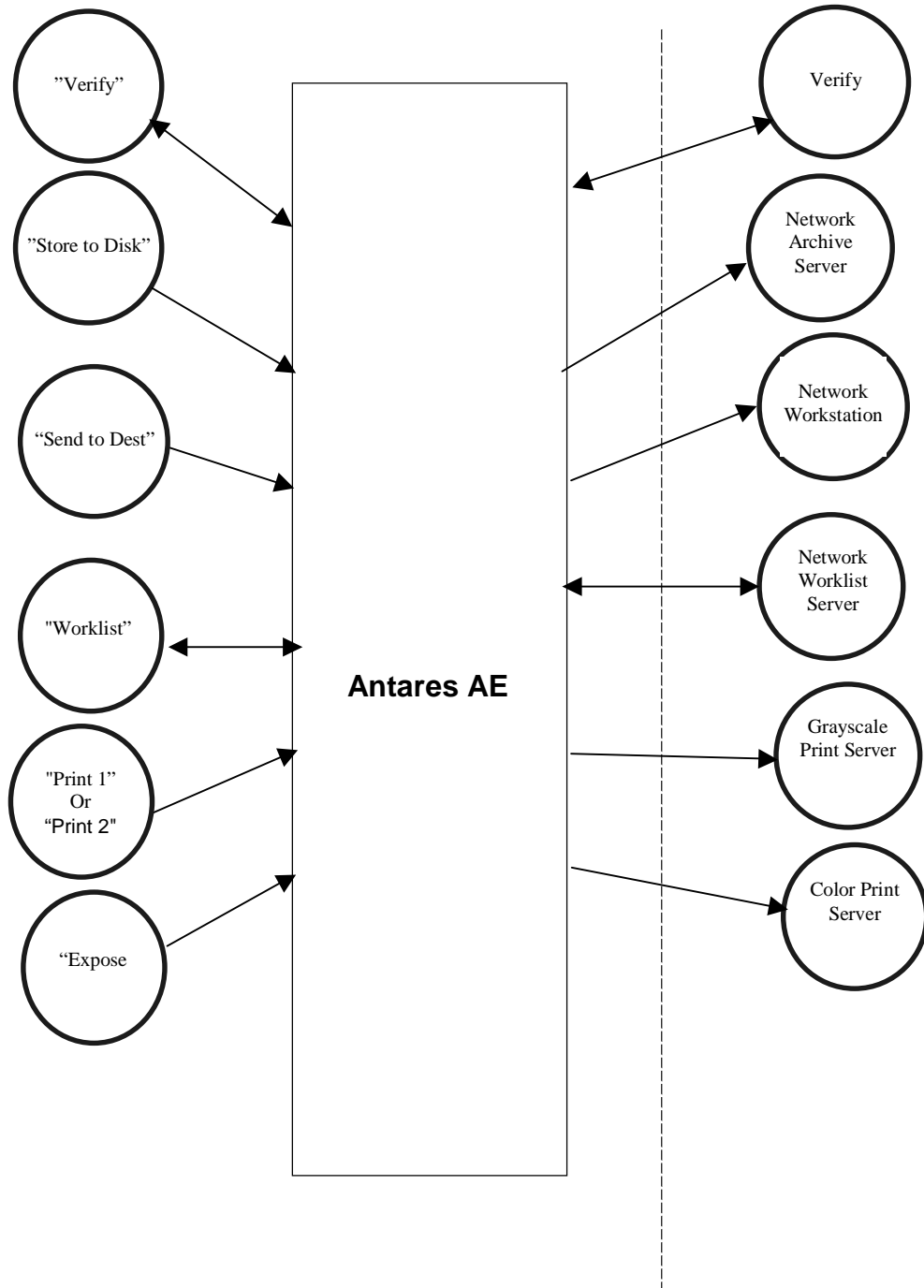
The following data fields will be populated on the patient data screen:

**Table 3: Patient Data Screen Fields**

Attribute Name	Tag
Patients Full Name	(0010,0010)
Patient ID	(0010,0020)
Accession Number	(0008,0050)
Date of Birth	(0010,0030)
Gender	(0010,0040)
Weight	(0010,1030)
Height	(0010,1020)
Physician	(0008,0090)
Exam Type	(0008,1030)
Additional Information	(0010,21B0)
Patient Comments	(0010,4000)

SONOLINE Antares Local Processes

Remote Processes



DICOM Standard Interface

Figure 5: Implementation Model

## **4.2 AE Functional Definition**

### **4.2.1 Verification Real-World Activities**

The Antares application entity supports Verification Service Class as SCU and SCP thus allowing the operator to verify the ability of an application on a remote node to receive DICOM messages. (C-ECHO DIMSE)

### **4.2.2 Store Real-World Activities**

The Antares application entity performs all of the functions necessary to transmit ultrasound image and associated data to network servers and/or workstations. The Antares AE supports the Ultrasound Image Storage SOP class as SCU. The AE initiates separate associations to the store servers, each time the user selects “Copy To Destination.”

### **4.2.3 Print Real-World Activities**

The Antares AE provides all aspects of the Print Management SCU. The AE initiates separate associations to the print servers, verifying their on-line status when the user selects “Print 1,” “Print 2” or “Expose Film Job.” The Antares AE accommodates both grayscale and color print servers.

### **4.2.4 Worklist Real-World Activity**

The Antares AE supports the DICOM Basic Worklist Management Service as an SCU. The AE initiates an association to the active Worklist server when a Worklist query is initiated from the “Patient Browser.” The association is closed upon the completion of each query.

### **4.2.5 Sequencing of Real-World Activities**

In order for any of the remote processes to be able to provide the Real World Activity SCP services which the SONOLINE Antares system, an SCU, has requested, the appropriate associations must have been previously opened. This initiation occurs with the “Send To Destination” for image store operations, “Print 1,” “Print 2,” and “Expose Film Job” for image printing operations, “Scheduler” for Worklist query operations.

## 5.0 AE Specifications

The following specifications apply to the AE as depicted in Figure 5 on page 11.

### 5.1 Antares AE Specification

The Antares AE provides conformance to the following DICOM Service SOP Classes as an SCU.

**Table 4: Supported SOP Classes**

Service SOP Class Name	SOP Class UID
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Verification	1.2.840.10008.1.1
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
Printer Job SOP Class	1.2.840.10008.5.1.1.14
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

#### 5.1.1 Association Establishment Policies

##### 5.1.1.1 General

The SONOLINE Antares system uses TCP/IP. The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU offered for an association initiated by Antares is:

- Maximum PDU Offered: 28762 bytes.

##### 5.1.1.2 Number of Associations

The Antares application initiates one/several association(s) at a time, one for each transfer request being processed.

- Print 1
- Print 2
- Copy To Destination or Expose Film Job:
- Worklist

##### 5.1.1.3 Asynchronous Nature

All associations use the default synchronous mode of operation. Asynchronous Operations Window negotiations are not supported on the Antares.

### 5.1.1.4 Implementation Identifying Information

- Implementation Class UID: “1.3.12.2.1107.5.9.990801” (See below).
- Implementation Version Name (“SIEMENS\_SWFVA43O”).

## 5.1.2 Association Initiation by Real-World Activities

### 5.1.2.1 Real World Activity—Verification

The Antares is capable of supporting Verification Service Class.

Class as an SCU only Verification can be initiated as a singular event from the Service Configuration Menu to any configured SCP that supports Verification.

#### 5.1.2.1.1 Proposed Presentation Contexts—Verification

The Antares will propose Presentation contexts as shown in Table 5.

**Table 5: Verification Presentation Context Table**

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

### 5.1.2.2 Real World Activity—Store

The user selects “New Patient” at the start of each new patient examination. The user saves images to the Antares hard disk with the “Store to Disk” button.

#### 5.1.2.2.1 Associated Real World Activities

An association is established when the user initiates a “Send To Destination” operation from the Patient browser screen. Individual images or entire exams can be transferred to the selected DICOM Store device (C-STORE request). The association is opened when the first image of each exam is transferred and closed when the last image transfer is completed. If the C-STORE Response from the remote application contains an error status, the association is aborted.

### 5.1.2.2.2 Proposed Presentation Context

The following Presentation Context(s) is presented to the SCP in an A-Associate request for DIMSE C-STORE storage services. The storage services utilize C-STORE services, whose parameters are defined in PS 3.7.

**Table 6: Store Presentation Context Table**

Presentation Context Table					
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	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

The SONOLINE Antares system always acts as an SCU and is the client in a client-server model.

#### 5.1.2.2.2.1 SOP Specific Conformance to Storage Service SOP Classes

The Store REAL WORLD ACTIVITY provides standard extended conformance as an SCU for the following standard Storage Service Class SOP.

**Table 7: Supported SOP Classes**

Service SOP Class Name	SOP Class UID	Conformance Level
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Standard Extended
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Standard Extended

This is accomplished using the DIMSE C-STORE Service to whom the SCU issues a service request with a SOP instance that meets the requirements of the desired ultrasound IOD.

Table 8 denotes the attributes included in the Ultrasound Image Object as implemented on the Antares. Attributes not listed are not used.

**Table 8: US Image IOD Attributes used**

Module	Attribute	Tag	Notes
Patient	Patient's Name	(0010,0010)	ANTARES Patient Data Screen – Last Name, First & MI fields. Default is “Unknown”.
	Patient ID	(0010,0020)	ANTARES Patient Data Screen –ID field. Default is today’s date & time (i.e. 9804241022 = Apr. 24, 1998 – 10:22am).
	Patient's Birth Date	(0010,0030)	ANTARES Patient Data Screen –DOB field. Default is a zero length attribute.
	Patient's Sex	(0010,0040)	ANTARES Patient Data Screen –Gender field. M = maleF = female U=Unknown. Default is a zero length attribute.
	Patient Comments	(0010,4000)	This is the additional information field from patient registration page.
General Study	Study Instance UID	(0020,000D)	
	Study Date	(0008,0020)	Date the exam started.
	Study Time	(0008,0030)	Time the exam started.
	Referring Physician's Name	(0008,0090)	ANTARES Patient Data Screen – Physician field.
	Study ID	(0020,0010)	Set to “1”.
	Accession Number	(0008,0050)	ANTARES Patient Data Screen – Accession # field.
	Study Description	(0008,1030)	ANTARES Patient Data Screen – Exam Type field (e.g. Liver, Abdomen, etc.). Default is “Unknown”.
Patient Study	Admitting Diagnoses Description	(0008,1080)	ANTARES Patient Data Screen – Indications field.
	Patient’s Size	(0010,1020)	Patient height in meters. Default is zero length attribute.
	Patient’s Age	(0010,1010)	
	Patient’s Weight	(0010,1030)	Patient weight in kg. Default is zero length attribute.
	Patient History	(0010,21B0)	Mapped to Additional Info field in Patient Registration UI
	Additional Patient History	(0010,21B0)	This is the additional information field from patient registration page.

**Table 8: US Image IOD Attributes used**

<b>Module</b>	<b>Attribute</b>	<b>Tag</b>	<b>Notes</b>
General Series	Modality	(0008,0060)	Set to "US".
	Series Instance UID	(0020,000E)	
	Series Date	(0008,0021)	
	Series Time	(0008,0031)	
	Series Number	(0020,0011)	
	Series Description	(0008,103E)	ANTARES Patient Data Screen -Exam Type field.
	Operator Name	(0008,1070)	ANTARES Patient Data Screen – Sonographer Name
General Equipment	Manufacturer	(0008,0070)	Set to Siemens Medical Systems Ultrasound Group
	Institution Name	(0008,0080)	ANTARES System Presets – Organization Name field.
	Device Serial Number	(0008,1000)	Set to Antares serial number.
	Manufacturers Model Name	(0008,1090)	Set to Antares.
	SW Version	(0018,1020)	Set to current SW version.
	Institution Name	(0008,1040)	From system presets menu, basic menu.
General Image	Image Number	(0020,0013)	Image number is series (1 – n)
	Patient Orientation	(0020,0020)	Zero length attribute.
Image Pixel	Samples per Pixel	(0028,0002)	RGB = 3 Grayscale and Color Images
	Rows	(0028,0010)	Set to 600.
	Columns	(0028,0011)	Set to 800.
	Bits Allocated	(0028,0100)	Set to 8.
	Bits Stored	(0028,0101)	Set to 8.
	High Bit	(0028,0102)	Set to 7.
	Pixel Data	(7FE0, 0010)	
	Planar Configuration	(0028,0006)	=0
	Photometric Interpretation	(0028,0004)	RGB
	Pixel Representation	(0028,0103)	0000H = unsigned integer.

**Table 8: US Image IOD Attributes used**

Module	Attribute	Tag	Notes
US Image	Image Type	(0008,0008)	The Defined Terms for Value 3 are the current Application type (e.g. ABDOMIN, OB, etc.).
VOI LUT	Window Center	(0028,1050)	Set to 128.
	Window Width	(0028,1051)	Set to 256.
SOP Common	SOP Class UID	(0008,0016)	Always US Image – 1.2.840.10008.5.1.4.1.1.6.1
	SOP Instance UID	(0008,0018)	
	Specific Character Set	(0008,0005)	“ISO-IR 100”
Image Plane	Pixel Spacing	(0028,0030)	Pixel Spacing information is sent for all images

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NOTE: In addition to these elements the Antares uses private attributes as described on page 35.

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### 5.1.2.2.3 Error Handling

Table 9 indicates the possible response status codes, which a SCP may return following the SCU’s C-STORE-RSP command. Only those status responses that indicate some form of error condition are presented to the user.

A successful C-STORE operation will allow the AE to continue to the next action desired by the user.

**Table 9: C-STORE Status Responses**

Service Status	Further Meaning	Protocol Codes	Related Fields
Refused	Out of resources.	A7xx	None
Error	Data set does not match SOP Class.Cannot understand.	A9xxCxxx	None
Warning	Coercion of data Elements.Data set does not match SOP Class.Elements discarded.	B000B007B006	None
Success		0000	None

### 5.1.2.3 Real World Activity - Print

The system has two possible print configurations in the “Filming / OEM’s” preset page. When “Active” is selected, an association is opened after the last image on the film sheet is acquired and closed at the end of film sheet transfer. When configured in “Manual” the system spools images to the hard disk for transfer later. An association is opened for each of the film sheets transferred from the filming UI. The Print key or filming icons can be assigned to separate printers, or to the same DICOM print device, with separate configurations (e.g., one key for printing grayscale images and one for printing color images).

#### 5.1.2.3.1 Associated Real World Activities

An association is established when the user initiates an “Expose Film Job” operation from the Print UI screen. Individual images or entire exams can be transferred to the selected DICOM Print device. All formats (images) are converted to Standard\1-1 format then transferred to the destination printer. The association is opened when the first sheet of each selected exam is transferred and closed when the last sheet transfer is completed.

#### 5.1.2.3.2 Proposed Presentation Contexts

**Table 10: Presentation Context Table**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.1000 8.5.1.1.9	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		
Basic Film Session SOP Class	1.2.840.1000 8.5.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		
Basic film Box SOP Class	1.2.840.1000 8.5.1.2	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2		

**Table 10: Presentation Context Table**

<b>Presentation Context Table</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Basic Grayscale Image Box SOP Class	1.2.840.1000 8.5.1.1.4	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Printer SOP Class	1.2.840.1000 8.5.1.1.16	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Printer Job SOP Class	1.2.840.1000 8.5.1.1.14	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.1000 8.5.1.1.18	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Film Session SOP Class	1.2.840.1000 8.5.1.1	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Film Box SOP Class	1.2.840.1000 8.5.1.2	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Color Image Box SOP Class	1.2.840.1000 8.5.1.1.4.1	DICOM Explicit VR Little Endian DICOM Explicit VR Big Endian DICOM Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

**Table 10: Presentation Context Table**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Printer SOP Class	1.2.840.1000 8.5.1.1.16	DICOM Explicit VR Little Endian	1.2.840.100 08.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.100 08.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.100 08.1.2		
Printer Job SOP Class	1.2.840.1000 8.5.1.1.14	DICOM Explicit VR Little Endian	1.2.840.100 08.1.2.1	SCU	None
		DICOM Explicit VR Big Endian	1.2.840.100 08.1.2.2		
		DICOM Implicit VR Little Endian	1.2.840.100 08.1.2		

5.1.2.3.2.1 SOP Specific Conformance Statement

The Print AE provides standard conformance to the Grayscale Print Management Meta SOP Class and Basic Color Print Management Meta SOP Class as an SCU.

The application uses a setting platform to define the properties of the connected DICOM SCP. For example,

- Maximum number of print jobs in the queue.
- Maximum number of print copies.
- Supported film sizes of the connected DICOM SCP.
- Supported film formats of the DICOM SCP.
- Lookup table definition.

The printing is only suspended in the case of a failure return status of the SCP

**Table 11: Basic Gray Scale Print Management Meta SOP Classes**

SOP Class Name	SOP Class UID	Usage
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	Standard
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard
Printer JOB SOP Class	1.2.840.10008.5.1.1.14	Standard
Basic Color Print Management Meta SOP Classes		

**Table 12: Basic Color Print Management Meta SOP Classes**

SOP Class Name	SOP Class UID	Usage
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	Standard
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard
Printer JOB SOP Class	1.2.840.10008.5.1.1.14	Standard

All mandatory elements of these classes are supported.

5.1.2.3.2.1.1 SOP Specific Conformance to Basic Film Session SOP Class

The Basic Film Session information object definition describes all the user-defined parameters, which are common for all the films of a film session. The Basic Film Session refers to one or more Basic Film Boxes that are printed on one hardcopy printer.

The Antares DICOM Print application supports the following DIMSE Service Elements for the Basic Film session SOP Class as SCU:

- N-CREATE
- N-DELETE

The Basic Film Session SOP Class SOP Class N\_CREATE\_RQ (SCU) uses the following attributes described in Table 13.

**Table 13: Basic Film Session N\_CREATE\_RQ attributes**

Attribute Name	AttributeTag	Usage	Range	Description
Number of Copies	(2000,0010)	U	1 to 99	Number of requested film copies.
Medium Type	(2000,0030)	U	PAPER CLEAR FILM BLUE FILM	Media used for hardcopy; may be further limited by print vendor/server
Film Destination	(2000,0040)	U	MAGAZINE PROCESSOR	May be further limited by print vendor, and/or print server

The affected SOP Instance UID received in the N\_CREATE\_RSP message from the SCP will be saved internally and used for later requests like N\_DELETE\_RQ on the Basic Film Session SOP Class.

**Table 14: Attributes of the N\_DELETE\_RQ - Basic Film Session SOP Class**

Attribute Name	AttributeTag	Source of Information
Requested SOP Instance UID	(0008,0018)	Affected SOP Instance UID of N_CREATE_RSP on Basic Film Session.

The N\_DELETE\_RQ on the Basic Film Session SOP Class is used to delete the complete Basic Film Session SOP Instance hierarchy.

The Basic Film Session SOP Class interprets the status codes in Table 15 from (NCREATE\_RSP, N\_DELETE\_RSP messages).

**Table 15: Basic Film Session SOP status**

Service Status	Meaning	Protocol Codes
Failure	Film Session SOP Instances hierarchy does not contain film box SOP instances	C600
	Unable to create print job, print queue is full	C601
	Image size is larger than images box size	C603
Warning	Memory allocation not supported	B600
	Film session printing is not supported	B601
Warning	Film box does not contain image box (empty page)	B602
Success	Film belonging to the film session are accepted for printing	0000

#### 5.1.2.3.2.1.2 SOP Specific Conformance to Basic Film Box SOP Class

The Basic Film Box Information object definition describes all the user-defined parameters of one film of the film session. The Basic Film Box information description defines the presentation parameters, which are common for all images on a given sheet of film. The Basic Film Box refers to one or more Image Boxes.

Supported as SCU are:

**Table 16: Supported DIMSE Services for Basic Film Box SOP Class**

Name	Usage	Description
N-Create	M	Creates the Film Box.
N-Set	U	Not used.
N-Delete	U	Deletes the Film Box. Issued after each film is printed.
N-Action	M	PRINT. Sent after each Film Box is filled, and at the end of the exam to force a print of partially filled Film Box.

The Basic Film Box SOP Class N\_CREATE\_RQ message uses the attributes in Table 17. The used values for each attribute depend on how the DICOM printer is configured within the SONOLINE Antares product.

**Table 17: Used Basic Film Box N\_CREATE\_RQ attributes**

Attribute Name	Attribute Tag	Usage	Range	Description
Image Display Format	(2010,0010)	M	STANDARD\1,1	Always STANDARD\1,1
Film Orientation	(2010,0040)	M	PORTRAIT	Always set to PORTRAIT
Film Size ID	(2010,0050)	M	8INX10IN 10INX12IN 10INX14IN 11INX14IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM	Valid Film sheet Sizes
Magnification Type	(2010,0060)	M	REPLICATE BILINEAR CUBIC NONE	Used.
Min. Density	(2010,0120)	U	0-999	Used - printer specific
Max Density	(2010,0130)	U	0-999	Used - printer specific
Referenced Film Session Sequence	(2010,0500)	M	1.2.840.10008.5.1.1.1	
Referenced SOP Class UID	(0008,1150)	M		
Referenced SOP Instance UID	(0008,1155)	M		

The N\_CREATE\_RSP message from the SCP then contains the References Image Box Sequence with its SOP Class and Instance UID's, which is stored internally and then used for the Basic Image Box SOP Class N-SET RQ messages.

After all parameters for the Image boxes on the film sheet have been sent then the Antares DICOM Print application SCU will issue a N\_ACTION\_RQ message with the SOP Instance UID of the Basic Film Box (returned in the N\_CREATE\_RSP of the Basic Film Box SOP Class) and the Action Type ID set to 1.

The affected SOP Instance UID received in N\_CREATE\_RSP message from the SCP will be saved internally and can be used later for the N\_DELETE\_RQ request on the Basic Film Box SOP Class (see Table 18).

**Table 18: Attributes of the N\_DELETE\_RQ on the Basic Film Session SOP Class**

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0008,0018)	Affected SOP Instance UID of N_CREATE_RSP on Basic Film Box

The Basic Film Box SOP class interprets the status codes Table 19 from the N\_CREATE\_RSP, N\_DELETE\_RSP and N\_ACTION\_RSP messages.

**Table 19: Basic Film Box SOP status**

Service Status	Meaning	Protocol Codes
Failure	Unable to create print job; print queue is full	C602
	Image size is larger than image box size	C603
Warning	Film box does not contain image box (empty page)	B603
	Requested MinDensity or MaxDensity outside of printer's operating range	B605
Success	Film accepted for printing	0000

#### 5.1.2.3.2.1.3 SOP Specific Conformance to Basic Grayscale Image Box SOP Class

The Basic Grayscale Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the parameters and image pixel data, which apply to a single image of a sheet of film.

The Grayscale Image Box SOP Class uses only the N\_SET\_RQ with the attributes in Table 20.

**Table 20: Used Basic Grayscale Image Box N-Set attributes**

Name	Attribute	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
Basic Grayscale Image Sequence	(2020,0110)	M	
>Samples Per Pixel	(0028,0002)	M	1
>Photometric Interpretation	(0028,0004)	M	MONOCHROME2 for Grayscale images
>Rows	(0028,0010)	M	
>Columns	(0028,0011)	M	
>Pixel Aspect Ratio	(0028,0034)	M	
>Bits Allocated	(0028,0100)	M	8
>Bits Stored	(0028,0101)	M	8
>High Bit	(0028,0102)	M	7
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0, 0010)	M	

The Grayscale Image Box SOP Class interprets the following status codes:

**Table 21: Basic Grayscale Image Box SOP status**

Service Status	Meaning	Protocol Codes
Failure	Image contains more pixels than printer can print in Image Box	C603
	Insufficient memory in printer to store the image	C605
Success		0000

#### 5.1.2.3.2.1.4 SOP Specific Conformance to Basic Color Image Box SOP Class

The Basic Color Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data, which apply to a single image of a sheet of film.

The Color Image Box SOP Class uses only the N\_SET\_RQ with the attributes in Table 22.

**Table 22: Used Basic Color Image Box N-Set attributes**

Name	Attribute	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
Basic Color Image Sequence	(2020,0111)	M	
>Samples Per Pixel	(0028,0002)	M	3
>Photometric Interpretation	(0028,0004)	M	RGB
>Planar Configuration	(0028,0006)	M	0
>Rows	(0028,0010)	M	
>Columns	(0028,0011)	M	
>Pixel Aspect Ratio	(0028,0034)	M	
>Bits Allocated	(0028,0100)	M	8
>Bits Stored	(0028,0101)	M	8
>High Bit	(0028,0102)	M	7
>Pixel Representation	(0028,0103)	M	0
>Pixel Data	(7FE0, 0010)	M	

The Color Image Box SOP Class interprets the status codes in Table 23.

**Table 23: Basic Color Image Box SOP status**

Service Status	Meaning	Protocol Codes
Warning	Image size larger than image box size	B604
Failure	Image contains more pixels than printer can print in Image Box	C603
	Insufficient memory in printer to store the image	C605
Success		0000

### 5.1.2.3.3 SOP Specific Conformance to Printer SOP Class

The Printer SOP Class has the possibility to monitor the status of the hardcopy printer in a synchronous and asynchronous way.

The Antares DICOM Print application uses the mandatory N-EVENT Report DIMSE service to monitor the changes of the printer status in an asynchronous way.

It can directly ask the Print SCP for it's status or can receive Events from the Print SCP asynchronously:

- N-GET as SCU
- N-EVENT-REPORT as SCU

In both cases the following information is supported.

**Table 24: Used Printer N-Event reports**

Event type name	Event	Attributes	Tag	Usage SCU
Normal	1	0000		
Warning	2	Printer status info	(2110,0020)	U
Failure	3	Printer status info	(2110,0020)	U

**Table 25: Mandatory Printer N\_GET\_RSP, N\_EVENT\_REPORT\_RQ attributes**

Attribute Name	Tag	Usage SCP	Supported Values
Printer Status	(2110,0010)	M	NORMAL FAILURE WARNING
Printer Status Info	(2110,0020)	M	SUPPLY EMPTY SUPPLY LOW RECEIVER FULL NO RECEIVE MGZ FILM JAM

#### 5.1.2.3.4 SOP Specific Conformance to Print Job SOP Class

The Print Job SOP Class has the possibility to monitor the execution of the print process.

The Antares DICOM Print application supports the optional N-Event Report DIMSE service to receive the changes of the print job status in an asynchronous way.

It can receive Events from the Print SCP asynchronously:

#### N-EVENT-REPORT

The following information is supported.

**Table 26: Used Print Job N-Event reports**

Event type name	Event	Attributes	Tag	Usage SCU
Normal	1	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	Print Queue Management SOP Class not supported
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Printing	2	Exception Status Info	(2100,0030)	U
		Printer Job ID	(2110,0020)	Print Queue Management SOP Class not supported
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Done	3	Exception Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	Print Queue Management SOP Class not supported
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Failure	4	Exception Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	Print Queue Management SOP Class not supported
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U

### 5.1.2.4 Real World Activity—Worklist

A separate Network association is established by the AE for each Worklist query operation, with only one active query at a time. The association is closed at completion of the query.

#### 5.1.2.4.1 Proposed Presentation Context

**Table 27: Worklist Presentation Context Table**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.1.2	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

The SONOLINE Antares system will always act as an SCU and be the client in a client-server model.

#### 5.1.2.4.1.1 SOP Specific Conformance to Modality Worklist Service SOP Class

The Antares Worklist AE provides conformance to the following DICOM Service SOP Classes as an SCU all at a standard extended level of conformance:

Table 28 provides the list of attributes requested in the Modality Worklist Query (C-FIND).

**Table 28: Modality Worklist Information Model Attributes**

Module	Attribute name	Tag	Match Type	Query Value
Scheduled Procedure Step	Scheduled Procedure Step Sequence	(0040,0100)	R	
	>Scheduled Station AE Title	(0040,0001)	R	Empty
	>Scheduled Procedure Step Start Date	(0040,0002)	R	Today - Today
	>Scheduled Procedure Step Start Time	(0040,0003)	R	0000 - 235959
	>Modality	(0008,0060)	R	Always “US”
	>Scheduled Performing Physician	(0040,0006)	R	NULL
Patient Identification	Patient’s Name	(0010,0010)	R	NULL
	Patient ID	(0010,0020)	R	NULL

**Table 29: Modality Worklist Return Key attributes used from the C\_FIND\_RSP**

Module	Attribute name	Tag	Return Key Type	Notes
SOP Common	Specific Character Set	(0008,0005)	1C	The Antares ignores this attribute.
Scheduled Procedure Step	Scheduled Procedure Step Sequence	(0040,0100)	1	
	>Scheduled Station AE Title	(0040,0001)	1	NULL
	>Scheduled Procedure Step Start Date	(0040,0002)	1	Date – Date Always set to today
	>Scheduled Procedure Step Start Time	(0040,0003)	1	
	Scheduled Procedure Step End Date	(0040,0004)	3	Always zero length
	Scheduled Procedure Step End Time	(0040,0005)	3	Always zero length
	>Modality	(0008,0060)	1	US
	>Scheduled Performing Physician	(0040,0006)	1	
	>Scheduled Procedure Step Description	(0040,0007)	1C	Updated in Patient Browser UI
	>Scheduled Action Item Code Sequence	(0040,0008)	1C	NULL
	>Pre-Medication	(0040,0012)	2C	
	>Scheduled Procedure Step ID	(0040,0009)	2	
	>Requested Contrast Agent	(0032,1070)	2C	
>Comments on the Scheduled Procedure Step	(0040,0400)	3		
Requested Procedure	Requested Procedure ID	(0040,1001)	1	
	Requested Procedure Description	(0032,1060)	1C	
	Requested Procedure Code Sequence	(0032,1064)	1C	
	Study Instance UID	(0020,000D)	1	
	Referenced Study Sequence	(0008,1110)	2	
	Requested Procedure Priority	(0040,1003)	2	

**Table 29: Modality Worklist Return Key attributes used from the C\_FIND\_RSP**

Module	Attribute name	Tag	Return Key Type	Notes
Imaging Service Request	Accession Number	(0008,0050)	2	Updated in Patient Browser UI
	Referring Physician Name	(0008,0090)	-	Updated in Patient Browser UI
Patient Identification	Patient's Name	(0010,0010)	-	Updated in Patient Browser UI
	Patient ID	(0010,0020)	-	Updated in Patient Browser UI
Patient Demographic	Patient's birth date	(0010,0030)	-	Updated in Patient Browser UI
	Patient's Sex	(0010,0040)	-	Updated in Patient Browser UI
	Patient's Weight	(0010,1030)	-	Updated in Patient Browser UI.

**5.1.2.4.2 Error Handling**

Table 30 indicates the possible response status codes, which a SCP may return following the SCU's C-FIND command. Only those status responses that indicate some form of error condition are presented to the user.

**Table 30: C-FIND Status Responses**

Service Status	Further Meaning	Protocol Codes
Refused	Out of resources	A700
Failed	Identifier does not match SOP Class	A900
	Unable to process	Cxxx
Cancel	Matching terminated due to Cancel request	FE00
Success	Matching is complete - No final Identifier is supplied.	0000
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	FF00
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or for this Identifier.	FF01

## 6.0 Communication Profiles

All SONOLINE Antares system application entities utilize the DICOM 3.0 TCP/IP communication support as defined in PS3.8 (Part 8) of the DICOM 3.0 Standard.

### 6.1 TCP/IP Stack Supported

Each process inherits its TCP/IP stack from the SONOLINE Antares's operating system TCP/IP stack. Port number 104 is used for DICOM communication with the Antares.

#### 6.1.1 Physical Media Supported

Standard representations of IEEE 802.3 (10 Base-T and 100 Base-T is supported)

## 7.0 Extensions/Specializations/Privatizations

### 7.1 Standard extended/specialized/private Syntaxes

Private elements used in the SONOLINE Antares system DICOM implementation are noted in Table 31.

### 7.2 Private Transfer Syntaxes

The SONOLINE Antares system implements private elements. The private elements are used between the Antares AE and other Syngo based AE's to describe Object Oriented Graphics (OOG). This module is used when object graphics are drawn on the image and stores the properties of the graphics objects. (Line, Circle, Rectangle, Arrows etc.) The graphics objects will remain re-animate-able even if such an image is transferred via the DICOM C-Store SOP Class.

The graphics objects are also stored in one Image overlay plane for compatibility with other products which don't support the OOG module. These private elements have to be discarded by non Syngo based DICOM application entities when modifying the image overlay data.

**Table 31: Siemens Private Data Elements**

Attribute Name	Tag	Private Creator	Type	Description
MEDCOM OOG Type	(0029,xx08)	SIEMENS MEDCOM OOG	1	MEDCOM Object Oriented Graphics (OOG) identification characteristics. Defined Terms: MEDCOM OOG 1
MEDCOM OOG Version	(0029,xx09)	SIEMENS MEDCOM OOG	3	Binary Data for 3D Reconstruction Version of MEDCOM OOG Info (0029,xx10)
MEDCOM OOG Info	(0029,xx10)	SEIMENS MEDCOM OOG	3	MEDCOM Object Oriented Graphics

## 8.0 Configuration

SONOLINE Antares Networking and DICOM parameters can be configured through the Antares Service configuration UI screens. The following configuration is supported:

- Network (local and remote)
- DICOM Store
- DICOM Print
- DICOM Worklist

### 8.1 Basic System Configuration

The following system parameters can be configured via the Antares System Presets Basic Menu screens. These parameters are mapped to DICOM image attributes:

- Organization Name
- Department Name
- System Location

#### 8.1.1 Organization Name

The user can enter the organization (e.g., hospital, clinic) as a text string in the Organization Name field of the System Presets - Basic menu. The Organization Name field is transferred to DICOM devices as Institution Name - DICOM data element (0008, 0080).

#### 8.1.2 Department Name

The user can enter the department name (e.g., ultrasound lab, OB/Gyn) as a text string in the Department Name field of the System Presets - Basic menu. The Department Name field is transferred to DICOM devices as Institutional Department Name - DICOM data element (0008, 1040).

#### 8.1.3 System Location

The user can enter the location where the ultrasound exam(s) are being performed in the System Location field of the System Presets - Basic menu. The System Location field will be transferred to DICOM devices as Station Name - DICOM data element (0008, 1010).

### 8.2 DICOM Network Configuration

DICOM and networking parameters can be configured for both the local Antares device and remote DICOM Service Class Providers through the Service Configuration User Interface.

### **8.2.1 Local**

The SONOLINE Antares local network parameters are configurable. The following network parameters can be configured for Antares device:

- Host Name
- IP address
- Network IP mask
- DICOM Application Entity Title

### **8.2.2 Remote**

Multiple DICOM Service Class Providers can be configured through the Service Configuration UI. The following network parameters can be configured for each remote device:

- Host name
- IP address
- Router/Gateway IP address

## **8.3 DICOM Store Configuration**

Remote DICOM Storage Service Class Providers are configured through the DICOM - Service Configuration menu. The following parameters can be configured:

- AET - Application Entity Title
- Port number
- IP Address
- Gateway)

## **8.4 DICOM Worklist Configuration**

Remote DICOM Worklist Service Class Providers are configured through the DICOM - Worklist page of the Service User Interface. The following parameters can be configured for each Worklist server:

- AET - Application Entity Title
- Port number
- IP Address

## 8.5 DICOM Print Configuration

For each DICOM Print server, the following data is configurable by the user using the Hardcopy Devices page of the Service User Interface. The user can change the page layout and the destination printer at any time during the operation of the Antares. The effect of changing parameters of the DICOM Print server will be seen at the next film sheet. The current film sheet is not affected by changing these parameters.

**Table 32: User Configurable Printer parameters**

<b>Parameter</b>	<b>Description</b>
Printer Type	Color or Black and White - depends on printer
Film Size	Select the size of the film - 8x10 inches, 14x17 inches
Film Orientation	Portrait Only
Display Format	Select from one of the following formats provided: One on One Two on One Four on One Six on One Nine on One Twelve on One Twenty on One
Print Priority	HIGH= Urgent
Medium Type	PAPER, CLEAR FILM, BLUE FILM, and Paper
Film Destination	MAGAZINE, PROCESSOR
Max. Density	Used to define the Black value - printer specific
Min. Density	Used to define the White value - printer specific
Smoothing Type	Printer specific value
Border Density	BLACK Only
Empty Image Density	BLACK Only
Trim	Yes / No - having a border around each image
Polarity	Normal/ Only

## 8.6 “Print” and “Store to Disk” Key Configuration

The Antares user can configure “Print 1 and Print2” to “Output Device” mapping through the System Presets - Filming / OEM menu. Images are acquired and sent to the assigned device when the user presses the associated key. The following key assignments are supported:

- Store to Disk – This key is assigned to Store images to hard disk.
- Print 1 – This key can be assigned to any configured DICOM Printer, or one of the ‘on-board’ OEM printer devices.
- Print 2 – This key can be assigned to any configured DICOM Printer, or one of the ‘on-board’ OEM printer devices.