

# SagiNova<sup>®</sup> 2.0



## DICOM Conformance Statement

### SagiNova<sup>®</sup> 2.0

Concerned Product: SagiNova<sup>®</sup> / SagiNova<sup>®</sup>-S / SagiNova<sup>®</sup>-Ir / SagiNova<sup>®</sup>-Ir-S  
Document Date: 07.2016  
Document Version: 01

## 1 Conformance Statement Overview

The DICOM functionality is valid for the following SagiNova® models:

Model	Software
SagiNova®	2.0.0
SagiNova® S	2.0.0
SagiNova® Ir	2.0.0
SagiNova® Ir-S	2.0.0

The optional DICOM functionality, as described in this document, may be enabled for a specific period of time by entering a code. When this DICOM functionality is enabled, SagiNova® can receive SagiPlan® generated DICOM RT Plans and use the contained information for brachy treatment. SagiNova® will report the results of the brachy treatment by means of generated DICOM RT Brachy Treatment Records.

**Table A.1-1. Network Services**

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Transfer</b>		
RT Plan Storage	No	Yes
RT Brachy Treatment Record Storage	Yes	No

## 2 Table of Contents

1 Conformance Statement Overview .....	2
2 Table of Contents .....	3
3 Introduction .....	6
3.1 Audience .....	6
3.2 Remarks .....	6
3.3 Terms and Definitions .....	6
3.4 Basics of DICOM Communication .....	7
3.5 Abbreviations .....	8
3.6 References .....	9
4 Networking .....	10
4.1 Implementation Model .....	10
4.1.1 Application Data Flow .....	10
4.1.2 Functional Definition of AEs .....	11
4.1.2.1 Functional Definition of SagiNova® Application Entity .....	11
4.2 AE Specifications: .....	12
4.2.1 SagiNova® Application Entity .....	12
4.2.1.1 SOP Classes .....	12
4.2.1.2 Association Policies .....	13
4.2.1.2.1 General .....	13
4.2.1.2.2 Number of Associations .....	13
4.2.1.2.3 Asynchronous Nature .....	13
4.2.1.2.4 Implementation Identifying Information .....	13
4.2.1.3 Association Initiation Policy .....	14
4.2.1.3.1 Activity - Verify Communication .....	14
4.2.1.3.1.1 Description and Sequencing of Activities .....	14
4.2.1.3.1.2 Proposed Presentation Contexts .....	14
4.2.1.3.1.3 SOP Specific Conformance for Verification SOP Class .....	14
4.2.1.3.2 Activity - Receive SagiPlan® RT Plan .....	14
4.2.1.3.3 Activity - Send RT Brachy Treatment Record .....	14
4.2.1.3.3.1 Description and Sequencing of Activities .....	14
4.2.1.3.3.2 Proposed Presentation Contexts .....	15
4.2.1.3.3.3 SOP Specific Conformance for RT Brachy Treatment Record Storage .....	15

4.2.1.4 Association Acceptance Policy.....	17
4.2.1.4.1 Activity - Verify Communication .....	17
4.2.1.4.1.1 Description and Sequencing of Activities .....	17
4.2.1.4.1.2 Accepted Presentation Contexts .....	17
4.2.1.4.1.3 SOP Specific Conformance for Verification SOP Class.....	17
4.2.1.4.2 Activity - Receive SagiPlan <sup>®</sup> RT Plan .....	17
4.2.1.4.2.1 Description and Sequencing of Activities .....	17
4.2.1.4.2.2 Accepted Presentation Contexts .....	18
4.2.1.4.2.3 SOP Specific Conformance for RT Plan Storage .....	18
4.2.1.4.3 Activity - Send RT Brachy Treatment Record .....	18
4.3 Network Interfaces .....	18
4.3.1 Physical Network Interface.....	18
4.3.2 Additional Protocols.....	19
4.3.3 IPv4 and IPv6 Support.....	19
4.4 Configuration .....	20
4.4.1 AE Title/Presentation Address Mapping .....	20
4.4.1.1 Local AE Titles .....	20
4.4.1.2 Remote AE Title/Presentation Address Mapping .....	20
4.4.1.2.1 SagiNova <sup>®</sup> Application Entity .....	20
4.4.2 Parameters .....	21
5 Media Interchange .....	22
6 Transformation of DICOM to CDA.....	23
7 Support of Character Sets .....	24
8 Security .....	25
8.1 Security Profiles .....	25
8.2 Association Level Security.....	25
8.3 Application Level Security .....	25
A. IOD Contents .....	26
A.1 Created SOP Instances .....	26
A.1.1 RT Brachy Treatment Record IOD .....	26
A.1.2 Patient Module .....	27
A.1.3 General Study Module .....	27
A.1.4 RT Series Module.....	28

A.1.5 General Equipment Module .....	28
A.1.6 RT General Treatment Record Module .....	29
A.1.7 RT Treatment Machine Record Module .....	29
A.1.8 RT Brachy Session Record Module .....	30
A.1.9 SOP Common Module .....	32
A.1.10 Private Module.....	33
A.2 Usage of Attributes From Received IODs .....	33
A.3 Attribute Mapping .....	33
A.4 Coerced/Modified Fields.....	33
B. Data Dictionary of Private Attributes.....	34
C. Coded Terminology and Templates .....	35
D. Grayscale Image Consistency.....	36
E. Standard Extended/Specialized/Private SOP Classes.....	37
E.1 Standard Extended SOP Class RT Brachy Treatment Record Storage .....	37
F. Private Transfer Syntaxes .....	38

## 3 Introduction

### 3.1 Audience

This document is written for the people that need to understand how SagiNova<sup>®</sup> 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.

### 3.2 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between SagiNova<sup>®</sup> and other DICOM products. 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.

### 3.3 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 Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.
Application Entity (AE)	An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.
Application Entity Title (AET)	The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.
Application Context	The specification of the type of communication used between Application Entities. Example: DICOM network protocol.
Association	A network communication channel set up between Application Entities.
Attribute	A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).
Information Object Definition (IOD)	The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions

	associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.
Joint Photographic Experts Group (JPEG)	A set of standardized image compression techniques, available for use by DICOM applications.
Media Application Profile	The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)
Module	A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.
Negotiation	First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.
Presentation Context	The set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.
Protocol Data Unit (PDU)	A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.
Security Profile	A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data
Service Class Provider (SCP)	Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).
Service Class User (SCU)	Role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)
Service/Object Pair Class (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 Instance (SOP Instance)	An information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.
Tag	A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]
Transfer Syntax	The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.
Value Representation (VR)	The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

## 3.4 Basics of DICOM Communication

A layman's introduction to DICOM may be included here. The following example may be used as a template:

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 worklists 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.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies "pre-negotiated" exchange media format, Abstract Syntax and Transfer Syntax.

## 3.5 Abbreviations

<b>AE</b>	Application Entity
<b>AET</b>	Application Entity Title
<b>DICOM</b>	Digital Imaging and Communications in Medicine
<b>IOD</b>	<b>Information Object Definition</b>
<b>IPv4</b>	<b>Internet Protocol version 4</b>
<b>IPv6</b>	<b>Internet Protocol version 6</b>
<b>ISO</b>	<b>International Organization for Standards</b>
<b>PACS</b>	<b>Picture Archiving and Communication System</b>
<b>PDU</b>	<b>Protocol Data Unit</b>
<b>SCP</b>	<b>Service Class Provider</b>
<b>SCU</b>	<b>Service Class User</b>
<b>SOP</b>	<b>Service-Object Pair</b>



**TCP/IP** Transmission Control Protocol/Internet Protocol

**UL** Upper Layer

**VR** Value Representation

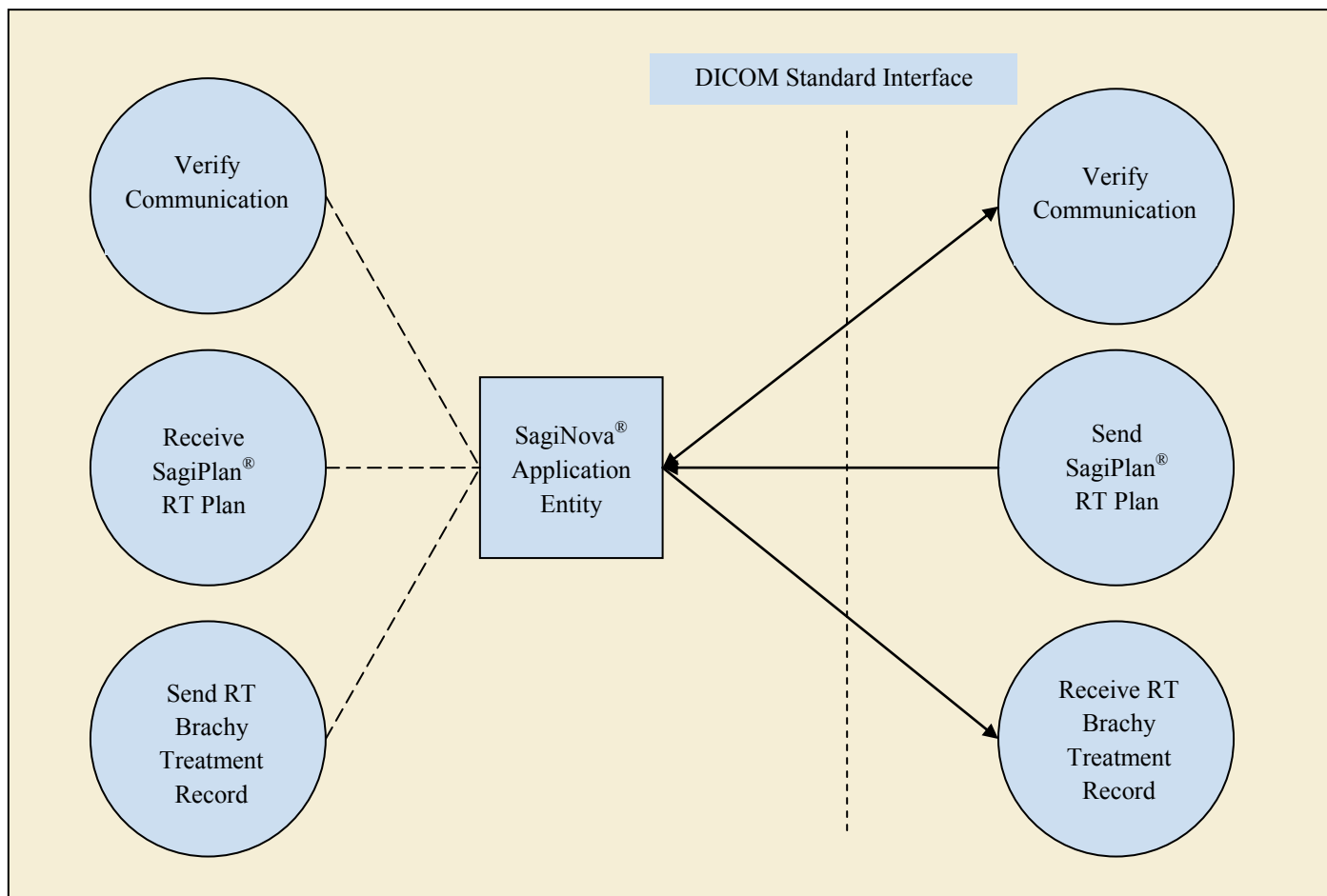
## 3.6 References

Reference	Document ID	Description
[DICOM]	DICOM PS3	NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at <a href="http://medical.nema.org/">http://medical.nema.org/</a>
[SAGIPLAN_DCS]	AA15-0028-01	SagiPlan <sup>®</sup> DICOM Conformance Statement.
[USER_MANUAL]	TD23_202 / TD23_203	User Manual SagiNova <sup>®</sup> .

## 4 Networking

### 4.1 Implementation Model

#### 4.1.1 Application Data Flow



**Figure 1 Application Data Flow Diagram**

- The “SagiNova<sup>®</sup> Application Entity” receives RT Plans (that are generated by SagiPlan<sup>®</sup>) from a remote AE and sends generated RT Brachy Treatment Records to a remote AE. This is associated with the local real-world activities “Receive SagiPlan<sup>®</sup> RT Plan” and “Send RT Brachy Treatment Record”. The “SagiPlan<sup>®</sup> Application Entity” also allows for verifying the communication, both as a SCU and SCP. This is associated with the local real-world activity “Verify Communication”.

## 4.1.2 Functional Definition of AEs

### **4.1.2.1 Functional Definition of SagiNova<sup>®</sup> Application Entity**

SagiNova<sup>®</sup> will only allow the user to import the information from a received RT Plan when the RT Plan has been created by SagiPlan<sup>®</sup> and the checksums are correct. In all other cases, this will not be possible and an error will be displayed to the user for the received RT Plan.

When a RT Plan is imported, the user has a choice to only import one fraction or all fractions.

When irradiation for a single fraction takes place and no interruption happens, a fraction with a maximum of 25 channels will result in the creation of one RT Brachy Treatment Record. When more channels are present (with a maximum of 50 channels) two RT Brachy Treatment Records will be created. When an irradiation is interrupted and continues later on, this will result in an extra created RT Brachy Treatment Record.

An option is available to automatically send a created RT Brachy Treatment Record to a configured remote Application Entity. When this fails, no automatic retry will be performed.

The user will always have the possibility to manually send a RT Brachy Treatment Record to a remote Application Entity.

See [USER\_MANUAL] for more information.

## 4.2 AE Specifications:

### 4.2.1 SagiNova<sup>®</sup> Application Entity

#### 4.2.1.1 SOP Classes

SagiNova<sup>®</sup> provides Standard Conformance to the following SOP Classes:

**Table 1 SOP Classes for SagiNova<sup>®</sup> Application Entity**

SOP Class Name	SOP Class UID	SCU	SCP
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	No
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes

## 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:

**Table 2 DICOM Application Context for SagiNova<sup>®</sup> Application Entity**

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

### 4.2.1.2.2 Number of Associations.

SagiNova<sup>®</sup> only allows for one incoming DICOM Association at the same time for receiving SagiPlan<sup>®</sup> RT Plans. When a new A-ASSOCIATE-RQ is received while another incoming DICOM Association is being handled, this new request will be rejected.

SagiNova<sup>®</sup> will send generated RT Brachy Treatment Records one at a time sequentially, each one in a separate DICOM Association.

**Table 3 Number of Associations as an Association Initiator for SagiNova<sup>®</sup> Application Entity**

Maximum number of simultaneous associations	1
---	---

**Table 4 Number of Associations as an Association Acceptor for SagiNova<sup>®</sup> Application Entity**

Maximum number of simultaneous associations	1
---	---

### 4.2.1.2.3 Asynchronous Nature

SagiNova<sup>®</sup> does not support asynchronous communication (multiple outstanding transactions over a single Association).

### 4.2.1.2.4 Implementation Identifying Information

The implementation information for this Application Entity is:

**Table 5 DICOM Implementation Class and Version for SagiNova<sup>®</sup> Application Entity**

Implementation Class UID	1.2.826.0.1.3680043.9.5562.1.1
Implementation Version Name	SagiNova <sup>®</sup>

## 4.2.1.3 Association Initiation Policy

### 4.2.1.3.1 Activity - Verify Communication

#### 4.2.1.3.1.1 Description and Sequencing of Activities

SagiNova<sup>®</sup> sends one C-ECHO-RQ in a DICOM Association.

#### 4.2.1.3.1.2 Proposed Presentation Contexts

SagiNova<sup>®</sup> is capable of proposing the Presentation Contexts shown in the following table:

**Table 6 Proposed Presentation Contexts for Activity Verify Communication**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

#### 4.2.1.3.1.3 SOP Specific Conformance for Verification SOP Class

SagiNova<sup>®</sup> provides Standard conformance to the DICOM Verification SOP Class.

### 4.2.1.3.2 Activity - Receive SagiPlan<sup>®</sup> RT Plan

No DICOM Association will be initiated during this activity.

### 4.2.1.3.3 Activity - Send RT Brachy Treatment Record

#### 4.2.1.3.3.1 Description and Sequencing of Activities

Each RT Brachy Treatment Record will be sent in a separate DICOM Association, one at a time.

## 4.2.1.3.3.2 Proposed Presentation Contexts

SagiNova<sup>®</sup> is capable of proposing the Presentation Contexts shown in the following table:

**Table 7 Proposed Presentation Contexts for Activity Send RT Brachy Treatment Record**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

SagiNova<sup>®</sup> will propose two presentation contexts, one with Transfer Syntax Explicit VR Little Endian and one with Transfer Syntax Implicit VR Little Endian. If both presentation contexts are accepted by the remote AE, the RT Brachy Treatment Record Storage will be sent using Transfer Syntax Explicit VR Little Endian.

## 4.2.1.3.3.3 SOP Specific Conformance for RT Brachy Treatment Record Storage

The behavior of SagiNova<sup>®</sup> when encountering status codes in a C-STORE response is summarized in the table below:

**Table 8 C-STORE Response Status Handling Behavior**

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	In the treatment detail screen, the RT Brachy Treatment Record will be displayed as “exported”.
Warning	*	*	In the treatment detail screen, the RT Brachy Treatment Record will be displayed as “exported”.
Failure	*	*	In the treatment detail screen, the RT Brachy Treatment Record will be displayed as “failed to export”.

The behavior of the AE during communication failure is summarized in the table below:

**Table 9 C-STORE Communication Failure Behavior**

Exception	Behavior
Timeout or Association aborted before C-STORE-RSP has been received	In the treatment detail screen, the RT Brachy Treatment Record will be displayed as “failed to export”.

Exception	Behavior
Timeout or Association aborted after C-STORE-RSP has been received	See table "Table 8 C-STORE Response Status Handling Behavior".



## 4.2.1.4 Association Acceptance Policy

### 4.2.1.4.1 Activity - Verify Communication

#### 4.2.1.4.1.1 Description and Sequencing of Activities

SagiNova® sends back a C-ECHO-RSP when receiving a C-ECHO-RQ in a DICOM Association.

#### 4.2.1.4.1.2 Accepted Presentation Contexts

SagiNova® will accept Presentation Contexts as shown in the table below:

**Table 10 Acceptable Presentation Contexts for Activity Verify Communication**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

SagiNova® will prefer to select the Explicit VR Little Endian Transfer Syntax if multiple transfer syntaxes are offered.

#### 4.2.1.4.1.3 SOP Specific Conformance for Verification SOP Class

SagiNova® provides Standard conformance to the DICOM Verification SOP Class.

### 4.2.1.4.2 Activity - Receive SagiPlan® RT Plan

#### 4.2.1.4.2.1 Description and Sequencing of Activities

SagiNova® only allows for one incoming DICOM Association at the same time for receiving one or more SagiPlan® RT Plans. When a new A-ASSOCIATE-RQ is received while another incoming DICOM Association is being handled, this new A-ASSOCIATE-RQ will be rejected.

#### 4.2.1.4.2.2 Accepted Presentation Contexts

SagiNova® will accept Presentation Contexts as shown in the table below:

**Table 11 Acceptable Presentation Contexts for Activity Receive SagiPlan® RT Plan**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Implicit VR Little Endian	1.2.840.10008.1.2		

SagiNova® will prefer to select the Explicit VR Little Endian Transfer Syntax if multiple transfer syntaxes are offered.

#### 4.2.1.4.2.3 SOP Specific Conformance for RT Plan Storage

The reasons for SagiNova® for sending specific status codes in a C-STORE response are summarized in the table below:

**Table 12 C-STORE Response Status**

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	When no problem is detected.
Failure	Cannot understand	C000	When one of the following problems is detected: <ul style="list-style-type: none"> <li>- Corrupt byte stream;</li> <li>- Incorrect VR's.</li> </ul>

#### 4.2.1.4.3 Activity - Send RT Brachy Treatment Record

No DICOM Association will be accepted during this activity.

## 4.3 Network Interfaces

### 4.3.1 Physical Network Interface

Two Ethernet network adapters will be available in the SagiNova® Windows 7 Workstation:

- One for the connection with the TCP (has a hardcoded IP address)
- One for the connection with the hospital network (will be configured according to hospital IT)

## 4.3.2 Additional Protocols

Not applicable.

## 4.3.3 IPv4 and IPv6 Support

Only IPv4 will be supported.

## 4.4 Configuration

### 4.4.1 AE Title/Presentation Address Mapping

#### 4.4.1.1 Local AE Titles

Table 13 Local AE Title Configuration

Application Entity	Default AE Title	Default TCP/IP Port
SagiNova <sup>®</sup> Application Entity	N/A (no default present)	N/A (no default present)

#### 4.4.1.2 Remote AE Title/Presentation Address Mapping

##### 4.4.1.2.1 SagiNova<sup>®</sup> Application Entity

Only one remote application entities may be configured that will act as a Storage SCP. When performing a DICOM network export (automatic or manual), the RT Brachy Treatment Record will be sent to this configured remote application entity.

For this single remote application entity, the following is configured:

- IP address;
- Port number;
- Application Entity Title.

Two configurations are possible in the context of receiving an incoming DICOM Association request:

- Allow any remote AE to initiate a DICOM association with SagiNova<sup>®</sup>;
- Only allow remote AE's to initiate a DICOM association with SagiNova<sup>®</sup> for which the AE titles have been configured. When the calling AE title (that is part of the A-ASSOCIATE-RQ) is not configured, the DICOM Association will be rejected by SagiNova<sup>®</sup>.

When the called AE title in the incoming A-ASSOCIATE-RQ differs from the configured SagiNova<sup>®</sup> Application Entity title, the DICOM Association will also be rejected.

## 4.4.2 Parameters

The table below summarizes the DICOM configuration parameters:

**Table 14 Configuration Parameters Table**

Parameter	Configurable (Yes/No)	Default Value
<b>SagiNova<sup>®</sup> Application Entity</b>		
DICOM functionality	Yes	Disabled
Time-out waiting for acceptance or rejection Response to an Association Open Request.	No	60 seconds
Time-out waiting for a C-STORE-RSP	No	60 seconds
Maximum PDU size the AE can receive	No	64k
Maximum PDU size the AE can send	No	64k
Number of simultaneous incoming DICOM Associations	No	1
Number of simultaneous outgoing DICOM Associations	No	1

A code may be entered in a DICOM option screen to enable the DICOM functionality for a specific period of time.

## 5 Media Interchange

Not applicable.

*Note:*

*Although files, that have the format as specified in [1] part 10, may be read and written, the DICOM interface of the SagiNova<sup>®</sup> does not support DICOM media interchange as there will be no support for DICOMDIR.*

## 6 Transformation of DICOM to CDA

Not applicable.

## 7 Support of Character Sets

The DICOM interface of SagiNova<sup>®</sup> is default character set and UNICODE oriented.

SagiNova<sup>®</sup> expects that the imported SagiPlan<sup>®</sup> RT Plan contains "ISO\_IR 192" as single value in the Specific Character Set attribute. A person name will be retrieved from the Ideographic component group that is part of the Patient Name attribute value.

When SagiNova<sup>®</sup> exports a generated RT Brachy Treatment Record, the Specific Character Set attribute will always contain "ISO\_IR 192" as single value. For a person name, the family name and given name will be stored in the Ideographic component group. The Alphabetic component group will be empty and the Phonetic component group will not be present.



## 8 Security

### 8.1 Security Profiles

Not applicable.

### 8.2 Association Level Security

Two configurations are possible in the context of receiving an incoming DICOM Association request:

- Allow any remote AE to initiate a DICOM association with SagiNova<sup>®</sup>;
- Only allow remote AE's to initiate a DICOM association with SagiNova<sup>®</sup> for which the AE titles have been configured. When the calling AE title (that is part of the A-ASSOCIATE-RQ) is not configured, the DICOM Association will be rejected by SagiNova<sup>®</sup>.

When the called AE title in the incoming A-ASSOCIATE-RQ differs from the configured SagiNova<sup>®</sup> Application Entity title, the DICOM Association will also be rejected.

### 8.3 Application Level Security

User accounts need to be configured for SagiNova<sup>®</sup> that include a user name and password. To access the application that runs on the Windows 7 Workstation, a valid user name and password for a user account is required. To be able to change the SagiNova<sup>®</sup> configuration items (including the DICOM configuration items), admin privileges need to be configured for a user account.

## A. IOD Contents

### A.1 Created SOP Instances

The following abbreviations will be used in the next subsections for the “Presence of...” columns:

- **VNAP**: Value Not Always Present (attribute sent zero length if no value is present)
- **ANAP**: Attribute Not Always Present
- **ALWAYS**: Always Present with a value
- **EMPTY**: Attribute is sent without a value

The following abbreviations will be used in the next subsections for the “Source” columns:

- **USER**: the attribute value source is from User input
- **RTPLAN**: the attribute value is the same as the value from an imported RT Plan attribute
- **CONFIG**: the attribute value source is a configurable parameter
- **AUTO**: the attribute value is generated automatically

#### A.1.1 RT Brachy Treatment Record IOD

The following table contains the IOD of Created RT Brachy Treatment Record Instances:

**Table 15 IOD of Created RT Brachy Treatment Record Instances**

IE	Module	Reference	Presence of Module
Patient	Patient	Table 16	ALWAYS
Study	General Study	Table 17	ALWAYS
Series	RT Series	Table 18	ALWAYS
Equipment	General Equipment	Table 19	ALWAYS
Treatment Record	RT General Treatment Record	Table 20	ALWAYS
	RT Treatment Machine Record	Table 21	ALWAYS
	RT Brachy Session Record	Table 22	ALWAYS

IE	Module	Reference	Presence of Module
	SOP Common	Table 23	ALWAYS
	Private	Table 24	ALWAYS

## A.1.2 Patient Module

The following table contains the Patient Module of Created SOP Instances:

**Table 16 Patient Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	Value from associated RT Plan is used.  The patient name is encoded using UTF-8 using the following format: "=" + <family name> + "^" + <given name>	ALWAYS	RTPLAN
Patient ID	(0010,0020)	LO	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Patient's Birth Date	(0010,0030)	DA	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Patient's Sex	(0010,0040)	CS	Value from associated RT Plan is used.	ALWAYS	RTPLAN

## A.1.3 General Study Module

The following table contains the General Study Module of Created SOP Instances:

**Table 17 General Study Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Study Date	(0008,0020)	DA	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Study Time	(0008,0030)	TM	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Referring Physician's Name	(0008,0090)	PN	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Study ID	(0020,0010)	SH	Value from associated RT Plan is used.	ALWAYS	RTPLAN

Attribute Name	Tag	VR	Value	Presence of Value	Source
Accession Number	(0008,0050)	SH	N/A	EMPTY	AUTO

## A.1.4 RT Series Module

The following table contains the RT Series Module of Created SOP Instances:

**Table 18 RT Series Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	"RTRECORD"	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	Unique UID is generated by device.	ALWAYS	AUTO
Series Number	(0020,0011)	IS	Integer number starting at 1 for the first irradiation of the associated RT Plan. Increased with 1 for each next irradiation.	ALWAYS	AUTO
Operators' Name	(0008,1070)	PN	Name of the user that logged in on the system.	ALWAYS	CONFIG

## A.1.5 General Equipment Module

The following table contains the General Equipment Module of Created SOP Instances:

**Table 19 General Equipment Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	"Eckert & Ziegler BEBIG GmbH"	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	"SagiNova"	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	BEBIG determined device serial number.	ALWAYS	AUTO
Software Versions	(0018,1020)	LO	Versions of the different software parts.	ALWAYS	AUTO

## A.1.6 RT General Treatment Record Module

The following table contains the RT General Treatment Record Module of Created SOP Instances:

**Table 20 RT General Treatment Record Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	"1"	ALWAYS	AUTO
Treatment Date	(3008,0250)	DA	Measured value.	ALWAYS	AUTO
Treatment Time	(3008,0251)	TM	Measured value.	ALWAYS	AUTO
Referenced RT Plan Sequence	(300C,0002)	SQ	Contains one sequence item.	ALWAYS	AUTO
>Referenced SOP Class UID	(0008,1150)	UI	"1.2.840.10008.5.1.4.1.1.481.5"	ALWAYS	AUTO
>Referenced SOP Instance UID	(0008,1155)	UI	Value from associated RT Plan is used.	ALWAYS	RTPLAN

## A.1.7 RT Treatment Machine Record Module

The following table contains the RT Treatment Machine Record Module of Created SOP Instances:

**Table 21 RT Treatment Machine Record Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Treatment Machine Sequence	(300A,0206)	SQ	Contains one sequence item.	ALWAYS	AUTO
>Treatment Machine Name	(300A,00B2)	SH	N/A	EMPTY	AUTO
>Manufacturer	(0008,0070)	LO	"Eckert & Ziegler BEBIG GmbH"	ALWAYS	AUTO
>Institution Name	(0008,0080)	LO	N/A	EMPTY	AUTO
>Manufacturer's Model Name	(0008,1090)	LO	"SagiNova"	ALWAYS	AUTO
>Device Serial Number	(0018,1000)	LO	BEBIG determined device serial number.	ALWAYS	AUTO

## A.1.8 RT Brachy Session Record Module

The following table contains the RT Brachy Session Record Module of Created SOP Instances:

**Table 22 RT Brachy Session Record Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Number of Fractions Planned	(300A,0078)	IS	N/A	EMPTY	AUTO
Brachy Treatment Technique	(300A,0200)	CS	Value from associated RT Plan is used.	ALWAYS	RTPLAN
Brachy Treatment Type	(300A,0202)	CS	"HDR"	ALWAYS	AUTO
Recorded Source Sequence	(3008,0100)	SQ	Contains one sequence item.	ALWAYS	AUTO
>Source Number	(300A,0212)	IS	"0"	ALWAYS	AUTO
>Source Type	(300A,0214)	CS	"CYLINDER"	ALWAYS	AUTO
>Source Manufacturer	(300A,0216)	LO	Value from associated RT Plan is used.	ALWAYS	RTPLAN

# SagiNova<sup>®</sup> 2.0

Attribute Name	Tag	VR	Value	Presence of Value	Source
>Source Serial Number	(3008,0105)	LO	Internally stored.	ALWAYS	AUTO
>Source Isotope Name	(300A,0226)	LO	Internally stored.	ALWAYS	AUTO
>Source Isotope Half Life	(300A,0228)	DS	Internally stored.	ALWAYS	AUTO
>Source Strength Units	(300A,0229)	CS	"AIR_KERMA_RATE"	ALWAYS	AUTO
>Reference Air Kerma Rate	(300A,022A)	DS	Determined during measurement.	ALWAYS	AUTO
>Source Strength Reference Date	(300A,022C)	DA	Determined during measurement.	ALWAYS	AUTO
>Source Strength Reference Time	(300A,022E)	TM	Determined during measurement.	ALWAYS	AUTO
Treatment Session Application Setup Sequence	(3008,0110)	SQ	Contains one sequence item.	ALWAYS	AUTO
>Application Setup Type	(300A,0232)	CS	Value from associated RT Plan is used.	ALWAYS	RTPLAN
>Total Reference Air Kerma	(300A,0250)	DS	Measured and calculated.	ALWAYS	AUTO
>Current Fraction Number	(3008,0022)	IS	Value from attribute "Private Fraction Number" in associated RT Plan is used.	ALWAYS	RTPLAN
>Treatment Delivery Type	(300A,00CE)	CS	Determined by internal state of device.	ALWAYS	AUTO
>Treatment Termination Status	(3008,002A)	CS	Determined by internal state of device.	ALWAYS	AUTO
>Treatment Verification Status	(3008,002C)	CS	"NOT_VERIFIED"	ALWAYS	AUTO
>Recorded Channel Sequence	(3008,0130)	SQ	Number of sequence items is equal to actual number of recorded channels.	ALWAYS	AUTO
>>Channel Number	(300A,0282)	IS	Value from associated RT Plan is used.	ALWAYS	RTPLAN
>>Channel Length	(300A,0284)	DS	Value from associated RT Plan is used.	ALWAYS	RTPLAN
>>Specified Channel Total Time	(3008,0132)	DS	Recalculated value from associated RT Plan is used.	ALWAYS	AUTO

Attribute Name	Tag	VR	Value	Presence of Value	Source
>>Delivered Channel Total Time	(3008,0134)	DS	Measured by device.	ALWAYS	AUTO
>>Source Movement Type	(300A,0288)	CS	"STEPWISE"	ALWAYS	AUTO
>>Transfer Tube Number	(300A,02A2)	IS	Deduced from the channel number.	ALWAYS	AUTO
>>Transfer Tube Length	(300A,02A4)	DS	N/A	EMPTY	AUTO
>>Referenced Source Number	(300C,000E)	IS	"0"	ALWAYS	AUTO
>>Safe Position Exit Date	(3008,0162)	DA	Measured value.	ALWAYS	AUTO
>>Safe Position Exit Time	(3008,0164)	TM	Measured value.	ALWAYS	AUTO
>>Safe Position Return Date	(3008,0166)	DA	Measured value.	ALWAYS	AUTO
>>Safe Position Return Time	(3008,0168)	TM	Measured value.	ALWAYS	AUTO
>>Number of Control Points	(300A,0110)	IS	Calculated value.	ALWAYS	AUTO
>>Brachy Control Point Delivered Sequence	(3008,0160)	SQ	Contains an even number of sequence items.	ALWAYS	AUTO
>>>Treatment Control Point Date	(3008,0024)	DA	Measured value.	ALWAYS	AUTO
>>>Treatment Control Point Time	(3008,0025)	TM	Measured value.	ALWAYS	AUTO
>>>Control Point Relative Position	(300A,02D2)	DS	Measured value.	ALWAYS	AUTO

## A.1.9 SOP Common Module

The following table contains the SOP Common Module of Created SOP Instances:



**Table 23 SOP Common Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	"1.2.840.10008.5.1.4.1.1.481.6"	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Unique UID is generated by device.	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	"ISO_IR 192"	ALWAYS	AUTO

## A.1.10 Private Module

The following table contains the Private Module of Created SOP Instances:

**Table 24 Private Module of Created SOP Instances**

Attribute Name	Tag	VR	Value	Presence of Value	Source
Private Creator Data Element	(1003, 0010)	LO	"SagiNova"	ALWAYS	AUTO
Irradiation Data Check Sum 1	(1003, 1000)	UL	Calculated value.	ALWAYS	AUTO
Irradiation Data Check Sum 2	(1003, 1001)	UL	Calculated value.	ALWAYS	AUTO

## A.2 Usage of Attributes From Received IODs

SagiNova<sup>®</sup> expects that imported RT Plans have been created with a specific version of SagiPlan<sup>®</sup>. See [SAGIPLAN\_DCS] for more information about the content of the SagiPlan<sup>®</sup> generated RT Plans.

## A.3 Attribute Mapping

See section A.1 on how values from an imported RT Plan are used in a generated RT Brachy Treatment Record.

## A.4 Coerced/Modified Fields

Not applicable.

## B. Data Dictionary of Private Attributes

The following table lists the private attributes for the standard extended RT Brachy Treatment Record Storage SOP Class.

**Table 25 Data Dictionary of Private Attributes**

<b>Tag</b>	<b>Attribute Name</b>	<b>VR</b>	<b>VM</b>	<b>Attribute Description</b>
(1003, 0010)	Private Creator Data Element	LO	1	The Private Creator Data Element.
(1003, 1000)	Irradiation Data Check Sum 1	UL	1	First part of the Irradiation Data Check Sum.
(1003, 1001)	Irradiation Data Check Sum 2	UL	1	Second part of the Irradiation Data Check Sum.

## C. Coded Terminology and Templates

Not applicable.

## D. Grayscale Image Consistency

Not applicable.

## **E. Standard Extended/Specialized/Private SOP Classes**

This section describes Standard Extended SOP Class(es), Specialized SOP Class(es) or Private SOP Class(es) that are used.

### **E.1 Standard Extended SOP Class RT Brachy Treatment Record Storage**

SagiNova<sup>®</sup> defines extra private type 3 attributes, for generated instances, that have been added to the standard SOP Class RT Brachy Treatment Record. See Appendix B for the complete list of these extra private attributes.

## F. Private Transfer Syntaxes

Not applicable.