RADSpa™
DICOM Conformance Statement

1. INTRODUCTION

1.1. Scope and Field of Application

This document is the DICOM conformance statement for the RADSpa software developed by Telerad Tech Pvt. Ltd. This document contains details on how various components of the RADSpa software interfaces with other devices and applications that conform to the DICOM 3.0 standard. This document is meant for users involved in system design and system integration. It is understood that the user is familiar with the DICOM standard and related concepts.

1.2. Theory of operations

The RADSpa contains the following components:

- RADSpa Server – Provides storage and retrieval support
- RADSpa Viewer – Image viewer.

The RADSpa DICOM service receives and stores the images acquired on the modality and allows these to be retrieved at a later time. The RADSpa Viewer is a image viewing application integrated with the browser RIS client

1.2.1. Configuration Information Models

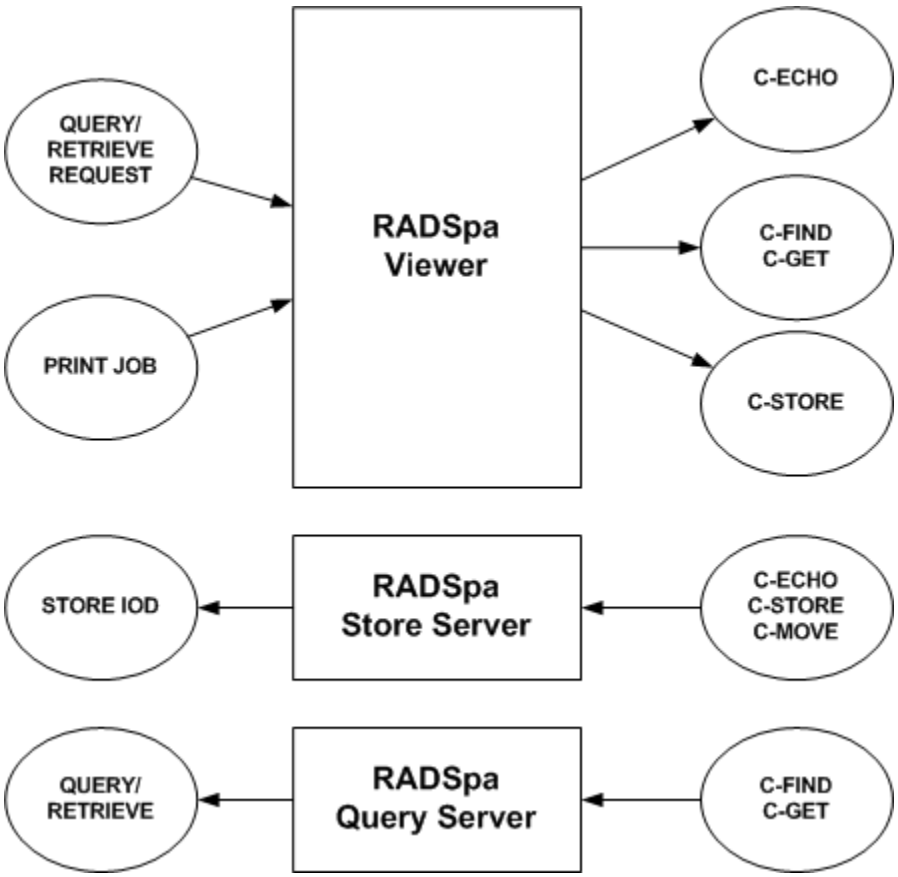
1.2.2. References and Definitions

All definitions have been taken from the Digital Imaging and Communications in Medicine (DICOM) standard, parts 1 through 18.

2. IMPLEMENTATION MODEL

2.1. Application Data Flow Diagram

The implementation for the RADSpa Server is shown below:



The RADSpa server is implemented as a background Windows Service. It is currently supported on the following operating systems:

- Windows 2003 Server
- Windows 2008 Server

It starts up automatically when the system starts up and shuts down when the system is shut down. The administrative user is provided with controls to manually start and stop the service. Some of the DICOM functions like the query retrieve requests; DICOM print is made directly by the viewing application. Since the DICOM server is implemented as a service, data can still be “sent” to the system even when the viewing application is not running.

2.2. Functional Definitions of Application Entities

All communications and image transfer with the remote application is accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack.
Below is a table of the functions supported by RADSpa application entities:

SCU	SCP
Verification	Verification
Storage	Storage
Query Retrieve	Query Retrieve
Basic Grayscale Print Management	

2.3. Sequencing of Real World activities

Not applicable.

3. APPLICATION ENTITY SPECIFICATIONS

3.1. AE Specifications for RADSpa Server DICOM services

The RADSpa Server AE provides support for the following DICOM SOP Classes as an SCU.

SOP Classes as an SCU	
SOP Class UID	**SOP Class Name**
Verification	
1.2.840.10008.1.1	Verification
Storage	
1.2.840.10008.5.1.4.1.1.1	CR Image Storage
1.2.840.10008.5.1.4.1.1.2	CT Image Storage
1.2.840.10008.5.1.4.1.1.1.1	Digital X Ray Image Storage for Presentation
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X Ray Image Storage for Processing
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-Ray Image Storage - For Presentation
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image Storage - For Processing
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (retired)
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage
1.2.840.10008.5.1.4.1.1.4	MR Image Storage
1.2.840.10008.5.1.4.1.1.5	Nuclear Medicine Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage
1.2.840.10008.5.1.4.1.1.11.1	Grayscale
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radiofluoroscopic Image Storage
1.2.840.10008.5.1.4.1.1.12.3	X-Ray Radiofluoroscopic Biplane Image Storage (retired)
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography (PET) Image Storage
Query Retrieve	
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve Model – FIND
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve Model – MOVE
1.2.840.10008.5.1.4.1.2.2.3	Study Root Query/Retrieve Model – GET
Print Management	
1.2.840.10008.5.1.1.9	Basic Grayscale Print Management

The RADSpa Server AE provides support for the following DICOM SOP Classes as an SCP.

SOP Classes as an SCP	
SOP Class UID	**SOP Class Name**
Verification	
1.2.840.10008.1.1	Verification
Storage	
1.2.840.10008.5.1.4.1.1.1	CR Image Storage
1.2.840.10008.5.1.4.1.1.2	CT Image Storage
1.2.840.10008.5.1.4.1.1.1.1	Digital X Ray Image Storage for Presentation
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X Ray Image Storage for Processing
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-Ray Image Storage - For Presentation
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image Storage - For Processing
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (retired)
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage
1.2.840.10008.5.1.4.1.1.4	MR Image Storage
1.2.840.10008.5.1.4.1.1.5	Nuclear Medicine Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage
1.2.840.10008.5.1.4.1.1.11.1	Grayscale
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radioflouroscopic Image Storage
1.2.840.10008.5.1.4.1.1.12.3	X-Ray Radioflouroscopic Biplane Image Storage (retired)
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography (PET) Image Storage
Query Retrieve	
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve Model – FIND
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve Model – MOVE
1.2.840.10008.5.1.4.1.2.2.3	Study Root Query/Retrieve Model – GET

3.1.1. Association establishment policies

3.1.1.1. General

The maximum PDU size for any association establishment is 16 KB.

3.1.1.2. Number of associations

The RADSpa Server AE will accept multiple associations both as SCP and SCU. As an SCP, the DICOM Service will listen for incoming associations and spawn a new thread to manage each request. This ability means it is possible for RADSpa to receive both images and query/retrieve requests from multiple SCUs simultaneously.

As an SCU, RADSpa can send images to multiple SCPs simultaneously, spawning a new thread for each destination.

3.1.1.3. Asynchronous nature

RADSpa does not support asynchronous operations.

3.1.1.4. Implementation identifying information

The implementation identifying information for the RADSpa Server is
Implementation class UID: 1.2.826.0.1.3680043.1.1.4.4.3.0

3.1.2. Association Initiation Policy

Any RADSpa component will initiate an association for the following activities:

- DICOM communication verification between RADSpa and a remote system.
- Sending images from RADSpa to a remote system.
- Querying of remote database contents.
- Retrieval of images from a remote location to RADSpa database.
- Print images

3.1.2.1. Real world activity – Verification

3.1.2.1.1. Associated real world activity

The Verification User AE provides standard conformance to the Verification class as SCU. No extended negotiation is used. The Verification User AE will request an association any time the user initiates a verification operation.

3.1.2.1.2. Proposed presentation contexts

Abstract Syntax Name	UID	Transfer Syntax	Role
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	SCU

3.1.2.2. Real world activity – Send images to a remote system

3.1.2.2.1. Associated real world activity

The RADSpa Server will initiate associations for the following reasons:

A C-MOVE / C-GET request is received from a remote AE and an association is initiated to perform a C-STORE sub operation.

A RADSpa user requests that a set of objects be sent to a remote DICOM AE and an association is initiated to perform a C-STORE sub operation.

3.1.2.2.2. Proposed Presentation Contexts

Presentation Context Table for sending images to a remote AET				
Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
UID	Name			
1.2.840.10008.5.1.4.1.1.1	CR Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.2	CT Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.1.1	Digital X Ray Image Storage for Presentation	See table	SCU	None
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X Ray Image Storage for Processing	See table	SCU	None
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-ray Image Storage - For Presentation	See table	SCU	None
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image Storage - For Processing	See table	SCU	None
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (retired)	See table	SCU	None
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.4	MR Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.5	Nuclear Medicine Image Storage (Retired)	See table	SCU	None
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)	See table	SCU	None
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radiofluoroscopic Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.12.3	X-Ray Radiofluoroscopic Biplane Image Storage (retired)	See table	SCU	None
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage	See table	SCU	None
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography (PET) Image Storage	See table	SCU	None

Transfer syntaxes for send to remote system	
Name	**UID**
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Implicit VR, Little Endian	1.2.840.10008.1.2
JPEG Lossless	1.2.840.10008.1.2.4.57
JPEG Lossless First Order	1.2.840.10008.1.2.4.70
JPEG 2000 lossless	1.2.840.10008.1.2.4.90
RLE Lossless	1.2.840.10008.1.2.5
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG 2000 lossy	1.2.840.10008.1.2.4.91

3.1.2.3. Real world activity – Query a remote database

3.1.2.3.1. Associated real world activity

The user uses a predefined filter configured to search a remote device or clicks on the query button in the advanced search window after entering the search criteria.

3.1.2.3.2. Proposed Presentation Contexts

Abstract Syntax Name	UID	Transfer Syntax	Role
Study Root Query Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	SCU

3.1.2.3.3. SOP specific conformance statement for SOP query class

The viewer supports C-FIND response values as defined in DICOM 3.0 Part 4. All Required and Unique keys are supported. The following optional keys are supported.

Data Level	Description	Tag	Type
Study	Study Date	(0008, 0020)	R
Study	Accession Number	(0008, 0050)	R
Study	Patient Name	(0010, 0010)	R
Study	Patient ID	(0010, 0020)	R
Study	Study Instance UID	(0020, 000D)	U
Study	Referring Doctor	(0008, 0090)	O
Study	Study Description	(0008, 1030)	O
Study	Patient Sex	(0010, 0040)	O
Series	Series Modality	(0008, 0060)	O
Series	Series Instance UID	(0020, 000E)	U
Series	Icon Image Sequence	(0088, 0200)	U
Image	Image Instance UID	(0008, 0018)	U

3.1.2.4. Real world activity – Retrieve from a remote system

3.1.2.4.1. Associated real world activity

The user selects one or more record from the list of results and clicks on Open Study. Upon retrieval the images are automatically populated into the local RADSpa database. This facilitates faster retrieval for subsequent searches.

3.1.2.4.2. Accepted Presentation Contexts

Presentation Context Table for retrieve from remote system				
Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
UID	Name			
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query Retrieve Information Model – MOVE	See table	SCU	None
1.2.840.10008.5.1.4.1.2.2.3	Study Root Query Retrieve Information Model – GET	See table	SCU	None

Transfer syntaxes for query of RADSpa Server database	
Name	UID
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Implicit VR, Little Endian	1.2.840.10008.1.2
Explicit VR, Big Endian	1.2.840.10008.1.2.2

3.1.2.5. Real world activity – Print to a DICOM printer

3.1.2.5.1. Associated real world activity

The users send images from the viewer to the composer. Here the user can change the print parameters and click on the print button.

3.1.2.5.2. Accepted Presentation Contexts

Presentation Context Table for print to DICOM printer				
Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
UID	Name			
1.2.840.1000.8.5.1.1.9	Basic Grayscale Print Management	Implicit VR, Little Endian	SCU	None

3.1.2.5.3. SOP specific conformance statement for SOP classes Basic Grayscale

Print Management Meta classes:
The following table contains a list of mandatory print SOP classes supported by the RADSpa as an SCU.

Basic Grayscale Print Management Meta classes	
SOP Class Name	**SOP Class UID**
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16

3.1.2.5.3.1. Conformance for SOP Class Basic Film Session

Basic Film Session SOP class N-CREATE: Attributes	
Description	**Tag**
Number of copies	(2000, 0010)
Print Priority	(2000, 0020)
Medium Type	(2000, 0030)
Film Destination	(2000, 0040)

3.1.2.5.3.2. Conformance for SOP Class Basic Film Box

Basic Film Box SOP class N-CREATE: Attributes	
Description	**Tag**
Print Priority	(2000, 0020)
Image Display Format	(2010, 0010)
Film Orientation	(2010, 0040)
Film Size ID	(2010, 0050)
Magnification Type	(2010, 0060)
Trim	(2010, 0140)

3.1.3. Association acceptance policies

RADSpa accepts associations for the activities listed below:

- DICOM communication between RADSpa and a remote system.
- Image transfer from a remote system to RADSpa.
- Processing remote system queries
- Initiation of image transfer to a remote system in response to a retrieve request.

RADSpa will reject any requests for an association from an AE that is unknown.

3.1.3.1. Real world activity – Verify communications with a remote system

3.1.3.1.1. Associated real world activity

RADSpa will send an echo response to verification requests made by remote systems.

Abstract Syntax Name	UID	Transfer Syntax	Role
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	SCP

3.1.3.2. Real world activity – Receive images from a remote system

3.1.3.2.1. Associated real world activity

A remote system pushes images to RADSpa.

3.1.3.2.2. Accepted Presentation Contexts

Presentation Context Table for receiving images from a remote AET				
Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
UID	Name			
1.2.840.10008.5.1.4.1.1.1	Computed Radiography Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.2	CT Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.1.1	Digital X Ray Image Storage for Presentation	See table	SCP	None
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X Ray Image Storage for Processing	See table	SCP	None
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-Ray Image Storage - For Presentation	See table	SCP	None
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image Storage - For Processing	See table	SCP	None
1.2.840.10008.5.1.4.1.1.3	US Multi-Frame Image Storage (retired)	See table	SCP	None
1.2.840.10008.5.1.4.1.1.3.1	US Multi-Frame Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.4	MR Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.5	Nuclear Medicine Image Storage (Retired)	See table	SCP	None
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)	See table	SCP	None
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.11.1	Grayscale	See table	SCP	None
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radiofloуroscopic Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.12.3	X-Ray Radiofloуroscopic Biplane Image Storage (retired)	See table	SCP	None
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage	See table	SCP	None
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography (PET) Image Storage	See table	SCP	None

Transfer syntaxes for receive from remote system	
Name	**UID**
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Implicit VR, Little Endian	1.2.840.10008.1.2
JPEG Lossless	1.2.840.10008.1.2.4.57
JPEG Lossless First Order	1.2.840.10008.1.2.4.70
JPEG 2000 lossless	1.2.840.10008.1.2.4.90
RLE Lossless	1.2.840.10008.1.2.5
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG 2000 lossy	1.2.840.10008.1.2.4.91

3.1.3.2.3. SOP specific conformance for SOP storage class

RADSpa conforms to the SOP's of the storage SOP class at level 2 (full). No elements are discarded or coerced by the RADSpa AE. In case of a successful C-STORE operation the object will be saved to the designated storage volume. If an image with the same SOP Instance UID (0008, 0018) already exists in the database; the new image will overwrite the existing image.

3.1.3.3. Real world activity – Query the RADSpa database

3.1.3.3.1. Associated real world activity

A remote system queries the RADSpa to determine what studies are present on the system.

3.1.3.3.2. Accepted Presentation Contexts

Presentation Context Table for query of RADSpa database				
Abstract Syntax		**Transfer Syntax**	**Role**	**Extended Negotiation**
UID	**Name**			
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query Retrieve Information Model – FIND	Implicit VR, Little Endian	SCP	None

3.1.3.3.3. SOP specific conformance statement for SOP query class

All required (R) and Unique (U) study and series level keys are supported for Study Root information model. The following table indicates the supported keys.

Level	Description	Tag	Support
STUDY	Patient ID	(0010, 0020)	Matching / Existence
	Patient Name	(0010, 0010)	Matching / Existence
	Patient Sex	(0010, 0040)	Matching / Existence
	Patient Birth Date	(0010, 0030)	Matching / Existence
	Study Date	(0008, 0020)	Matching / Existence
	Study UID	(0020, 000D)	Matching / Existence
	Study Description	(0008, 1030)	Matching / Existence
	Accession Number	(0008, 0050)	Matching / Existence
	Referring Physician	(0008, 0090)	Matching / Existence
	Modalities in study	(0008, 0061)	Matching / Existence
SERIES	Series UID	(0020, 000E)	Matching / Existence
	Series Description	(0008, 103E)	Existence
	Series number	(0020, 0011)	Existence
	Series Date	(0008, 0021)	Existence
	Series Time	(0008, 0031)	Existence
	Modality	(0008, 0060)	Existence
IMAGE	Instance UID	(0008, 0018)	Matching / Existence
	Image Number	(0020, 0013)	Existence
	Image Width	(0028, 0010)	Existence
	Image Height	(0028, 0010)	Existence

The RADSpa server also supported the following types of attribute matching:

- Single Value matching
- Universal matching
- Wild card matching
- Range matching

3.1.3.3.4. Accepted Presentation Contexts

RADSpa Server will accept all presentation contexts which match those of the preceding table. No acceptance or prioritization rules are required.

3.1.3.4. Real world activity – Retrieve from the RADSpa Server

3.1.3.4.1. Associated real world activity

The remote system retrieves one or more studies from the RADSpa database.

3.1.3.4.2. Accepted Presentation Contexts

Presentation Context Table for retrieve from RADSpa server database				
Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
UID	Name			
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query Retrieve Information Model – MOVE	See table	SCP	None
1.2.840.10008.5.1.4.1.2.2.3	Study Root Query Retrieve Information Model – GET	See table	SCP	None

Transfer syntaxes for retrieve from RADSpa Server database	
Name	UID
Explicit VR, Little Endian	1.2.840.10008.1.2.1
Implicit VR, Little Endian	1.2.840.10008.1.2
Explicit VR, Big Endian	1.2.840.10008.1.2.2

3.1.4. RADSpa DICOM Media Services

RADSpa conforms to the DICOM Media Storage Service and File Format (PS 3.10) and the Media Storage Application Profiles (PS 3.11) for reading images stored on a recordable media. The following application profile is supported by RADSpa:

Supported Application Profile	
Description	**Identifier**
General Purpose CD-R Image Interchange Profile	STD-GEN-CD

RADSpa through its supported application profile listed above supports the real world activities listed below:

Supported Application Profile		
Real world activity	**Role**	**SC Option**
Display directory of CD-R	FSR	Interchange
Read images from CD-R	FSR	Interchange

When importing DICOM images / DICOMDIR, the user has the option to import the images to the local database.

3.1.4.1. Read images from a CD-R

RADSpa assumes the role of a FSR when reading the DICOMDIR. The application will automatically display a hierarchical structure of the contents. The PatientID, Study UID, Series UID and Image Instance UID keys are used to distinguish between objects.

3.1.4.2. Image Export

RADSpa supports the creation of a General Purpose CD-R Image Interchange Profile as a File Set Creator. A conformant DICOMDIR file will be created as part of the file set, and image object files will be located in the appropriate directory structure, with proper Part 10 formatting.

3.2. Supported communication stacks

DICOM Part 8 is supported by RADSpa Server through TCP/IP.

3.3. TCP/IP Stack

The TCP/IP stack supported by RADSpa Server is inherited from the host operating system.

3.3.1. Physical Media Support

Any host operating system supported physical media.

4. EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

4.1. Standard extended/specialized/private SOPs

Not applicable

4.2. Private Transfer Syntaxes

Not applicable

5. CONFIGURATION

Local AE titles are configurable.

5.1. Standard extended/specialized/private SOPs

The local AE title can be configured by authorized users using the administration tool provided.

5.2. Configuration parameters

The following fields are configurable for store AE

- Local AE Title
- Secure Listening port (default – 2762)

The following fields are configurable for remote AE

- AE Title
- Port number
- Alias name
- IP Address
- Supported DICOM operations.

6. CONFIGURATION

No support of extended character sets is offered by RADSpa Server at this time.