

Advanced-Technology QA Consortium - File Set Reader Application DICOM Conformance Statement

VERSION 2.3

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Based on PS 3.x-2003 of the DICOM Standard

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DISCLAIMER: Please note that this document is a conformance statement for a Media Storage File Set Reader application currently in use by the Advanced Technology QA Consortium. Its release is intended to assist the development of Media Storage File Set Creator/Updater applications by other parties. Users of this document are cautioned that the Advanced Technology QA Consortium reserves the right to change specifications of Media Storage File Set Reader application as necessary for the support of advanced-technology clinical trials in radiotherapy.

A.1 DICOM Conformance Statement Overview

This document describes the Advanced Technology QA Consortium (ATC) implementation of an application for reading CD-R disks containing image and radiotherapy data which are submitted by institutions participating in multi-institutional, advanced-technology clinical trials in radiotherapy.

This implementation supports only DICOM Media Storage Service (SOP) Classes.

The Supported Media Storage Application Profiles is that for Compact Disk – Recordable. The supported role is File Set Reader.

Media Storage Application Profile	Creator/Updater of Media	Reader of Media
<i>Compact Disk - Recordable</i>		
STD- General Purpose CD	No/Not Applicable	Yes

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A.3 INTRODUCTION

This document describes the DICOM IODs and SOP classes which are used to exchange data between institutions participating in advanced-technology radiotherapy clinical trials and the Advanced Technology QA Consortium (ATC). It forms the specification for an implementation of a DICOM Part 10 File Set Reader.

The descriptions of DICOM IODs and attributes shown below are given in the context of the submission of image and radiotherapy treatment planning data acquired for the treatment of patients enrolled in cooperative-group clinical trials to the ATC. The role of the ATC is to evaluate the consistency of submitted data and to build a database of submitted image and treatment planning data to support studies of clinical outcomes. Comments regarding the usage of attributes in supported IODs reflect their use in the context of the multi-institutional clinical trials supported by the ATC.

A.4 NETWORKING

No networking related services are supported by this application.

A.6 MEDIA STORAGE

The Supported Media Storage Application Profiles is that for General Purpose CD-R Interchange (STD-GEN-CD). The supported role is File Set Reader. See PS 3-11, Annex D.

A.7 SUPPORT OF EXTENDED CHARACTER SETS

No Extended Character Sets are supported by this application.

A.8 SECURITY PROFILES

No security profiles are supported at this time.

A.9 ANNEXES

A.9.1 Created IOD:

No IODs are created by this application.

A.9.2 Used fields in received IOD by Application

Fields used by this Application are provided in tables in annexes A.9.4.1 through A.9.4.8. Descriptions of the required usage are included, as well. Attributes whose module name ends in "(IMAGE PIXEL)" are defined in "IMAGE PIXEL" but are given modality-specific specialization in their image modality modules. For example, "RT IMAGE (IMAGE PIXEL)" indicates that an attribute from the "IMAGE PIXEL" module has been specialized in the "RT IMAGE" module.

A.9.2.1 Patient Identification for Clinical Trials

Patient's Name (0010,0010) and Patient ID (0010,0020) are used as attributes in DICOM information objects and as selection keys in PATIENT level Directory Records for DICOM Media Storage to identify the patient who is the subject of the imaging and radiotherapy data. In the context of multi-institutional clinical trials, however, data must be identified by protocol-related rather than personal identification.

The DICOM Clinical Trials Identification Subject, Clinical Trials Study, and Clinical Trials Series modules provide a consistent means for identifying clinical trials data. These modules are type U (user-optional) for all DICOM composite objects.

Clinical Trials Identification						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	

NOTE: To provide identification of DICOM objects with applications that do not display the above Clinical Trials identification attributes, it is suggested that both the Patient's Name (0010,0010) and Patient ID (0010,0020) attributes in information objects and selection keys used in PATIENT-level Directory Records be constructed using the PN (Person Name) Value Representation with the following five caret-delimited fields:

Field	Content
Sponsor ID	Character string identifying the sponsor of the clinical trial, i.e., the cooperative study group identifier
Protocol ID	Identifier for the study protocol in which the subject is enrolled.
Subject ID	Identifier for the subject within the protocol in which he/she is enrolled.
Patient Initials	Initials of patient name, used to confirm identification
(unused)	

A.9.3 Data Dictionaries

Additional values are defined for Dose Type (3004,0004) to indicate whether heterogeneity correction was used in calculating the dose represented in the RT Dose IOD. Additional defined terms are PHYSICAL_HETERO = physical dose computed with heterogeneity correction (i.e., using image-derived tissue density information), and PHYSICAL_HOMO = physical dose computed without heterogeneity correction (i.e., assuming water density throughout the patient)..

Additional values are defined for Dose Summation Type (3004,000A) under the condition that total dose DVHs represented in the RT Dose IOD refer to an RT Plan which is not provided. In this case, Dose Summation Type must be one of the following terms: TOTALHOMO (indicates that DVHs are computed for total plan dose *without* heterogeneity correction, i.e., assuming water density), or TOTALHETERO (indicates that DVHs are computed for total plan dose *with* heterogeneity correction, i.e., using image-derived tissue density).

A.9.4 Standard Extended/Specialized/Private SOPs and Transfer Syntaxes

The table below lists the eight Standard SOP Classes and Transfer Syntaxes supported by this application. Each of these is defined in PS 3.3.

SOP Class Name	SOP Class UID	Transfer Syntax Name	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1

A.9.4.1 CT Image Storage

The table shown below lists the fields in the CT Image Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. Non-NULL values are required for fields whose Type is specified as 2*. References in the left-most column are to PS 3.3.

CT Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	

CT Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.1	GENERAL SERIES	Modality	(0008,0060)	1	CS	
C.7.3.1	GENERAL SERIES	Series Instance UID	(0020,000E)	1	UI	
C.7.3.1	GENERAL SERIES	Series Number	(0020,0011)	2	IS	
C.7.3.1	GENERAL SERIES	Patient Position	(0018,5100)	2C	CS	
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.7.4.1	FRAME OF REFERENCE	Frame of Reference UID	(0020,0052)	1	UI	
C.7.4.1	FRAME OF REFERENCE	Position Reference Indicator	(0020,1040)	2	LO	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C.7.6.1	GENERAL IMAGE	Instance Number	(0020,0013)	2	IS	
C.7.6.2	IMAGE PLANE	Pixel Spacing	(0028,0030)	1	DS	Only square pixels supported by ATC
C.7.6.2	IMAGE PLANE	Image Orientation (Patient)	(0020,0037)	1	DS	
C.7.6.2	IMAGE PLANE	Image Position (Patient)	(0020,0032)	1	DS	
C.7.6.2	IMAGE PLANE	Slice Thickness	(0018,0050)	2	DS	
C.7.6.3	IMAGE PIXEL	Rows	(0028,0010)	1	US	
C.7.6.3	IMAGE PIXEL	Columns	(0028,0011)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Representation	(0028,0103)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Data	(7FE0,0010)	1	OW/OB	
C.8.2.1	CT IMAGE	Image Type	(0008,0008)	1	CS	
C.8.2.1	CT IMAGE (IMAGE PIXEL)	Samples per Pixel	(0028,0002)	1	US	
C.8.2.1	CT IMAGE (IMAGE PIXEL)	Photometric Interpretation	(0028,0004)	1	CS	

CT Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.2.1	CT IMAGE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1	US	
C.8.2.1	CT IMAGE (IMAGE PIXEL)	Bits Stored	(0028,0101)	1	US	
C.8.2.1	CT IMAGE (IMAGE PIXEL)	High Bit	(0028,0102)	1	US	
C.8.2.1	CT IMAGE	Rescale Intercept	(0028,1052)	1	DS	
C.8.2.1	CT IMAGE	Rescale Slope	(0028,1053)	1	DS	
C.8.2.1	CT IMAGE	KVP	(0018,0060)	2	DS	
C.8.2.1	CT IMAGE	Acquisition Number	(0020,0012)	2	IS	
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

A.9.4.2 Media Storage Directory Storage

The table shown below lists the fields in the Media Storage Directory Storage SOP Class, which may be read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. References in the left-most column are to PS 3.3.

Note: information contained in the Media Storage Directory Storage SOP Class is not currently used by the ATC File Set Reader application. However, this SOP Class may be used in future implementations.

Basic Directory Information						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
3.F.3	File-Set Identification Module	File Set ID	(0004,1130)	2	CS	
3.F.3	Directory Information Module	Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	UL	
3.F.3	Directory Information Module	Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	UL	
3.F.3	Directory Information Module	File-set Consistency Flag	(0004,1212)	1	US	
3.F.3	Directory Information Module	Directory Record Sequence	(0004,1220)	2	SQ	
3.F.3	Directory Information Module	>Offset of the Next Directory Record	(0004,1400)	1C	UL	
3.F.3	Directory Information Module	>Record In-use Flag	(0004,1410)	1C	US	
3.F.3	Directory Information Module	>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	UL	
3.F.3	Directory Information Module	>Directory Record Type	(0004,1430)	1C	CS	See A.9.4.2.1, below
3.F.3	Directory Information Module	>Referenced File ID	(0004,1500)	1C	CS	

Basic Directory Information						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
3.F.3	Directory Information Module	>MRDR Directory Record Offset	(0004,1504)	1C	UL	
3.F.3	Directory Information Module	>Referenced SOP Class UID in File	(0004,1510)	1C	UI	
3.F.3	Directory Information Module	>Referenced SOP Instance UID in File	(0004,1511)	1C	UI	
3.F.3	Directory Information Module	>Referenced Transfer Syntax UID in File	(0004,1512)	1C	UI	
3.F.3	Directory Information Module	>Record Selection Keys	See PS 3.3 F.5	See PS 3.3 .F.5		See A.9.4.2.2, below.

A.9.4.2.1 Directory Record Types

The table shown below lists Directory Record Types used by this application in the Basic Directory Information of the Media Storage Directory Storage SOP Class and indicates those Directory Record Types which may be included in the next lower-level directory Entity for each.

Directory Record Type	Directory Record Types which may be included in the next lower-level directory Entity
(Root Directory Entity)	PATIENT
PATIENT	STUDY
STUDY	SERIES
SERIES	IMAGE, RT DOSE, RT STRUCTURE SET, RT PLAN
IMAGE	(none)
RT DOSE	(none)
RT STRUCTURE SET	(none)
RT PLAN	(none)

A.9.4.2.2 Record Selection Keys

The table shown below lists Record Selection Keys for each of the Directory Record Types used by this application in the Basic Directory Information of the Media Storage Directory Storage SOP Class. Note that several Record Selection Keys are mandatory (Type 1), while the corresponding attributes in the referenced object instances are of Type 2. E.g., Patient ID (0010,0020) has Type 1 as a Record Selection Key in a Directory Record Entity, whereas the Patient ID attribute in the referenced object file is of Type 2.

Record Selection Keys						
Ref #	Directory Record Type	Key	Tag	Type	VR	Comments
F.5.1	PATIENT	Patient's Name	(0010,0010)	2	PN	See A.9.2.1
F.5.1	PATIENT	Patient ID	(0010,0020)	1	LO	See A.9.2.1

Record Selection Keys						
Ref #	Directory Record Type	Key	Tag	Type	VR	Comments
F.5.2	STUDY	Study Date	(0008,0020)	1	DA	
F.5.2	STUDY	Study Time	(0008,0030)	1	TM	
F.5.2	STUDY	Study Description	(0008,1030)	2	LO	
F.5.2	STUDY	Study Instance UID	(0020,000D)	1C	UI	Required only if (0004,1511) is absent, i.e., Directory Record does not directly reference a SOP Instance. (See note in PS 3.3 F.5.2)
F.5.2	STUDY	Study ID	(0020,0010)	1	SH	
F.5.2	STUDY	Accession Number	(0008,0050)	2	SH	
F.5.3	SERIES	Modality	(0008,0060)	1	CS	
F.5.3	SERIES	Series Instance UID	(0020,000E)	1	UI	
F.5.3	SERIES	Series Number	(0020,0011)	1	IS	
F.5.4	IMAGE	Instance Number	(0020,0013)	1	IS	
F.5.19	RT DOSE	Instance Number	(0020,0013)	1	IS	
F.5.19	RT DOSE	Dose Summation Type	(3004,000A)	1	CS	See Comment for Dose Summation Type (3004,000A) in RT Dose IOD in Section A.9.4.5 of this document
F.5.20	RT STRUCTURE SET	Instance Number	(0020,0013)	1	IS	
F.5.20	RT STRUCTURE SET	Structure Set Label	(3006,0002)	1	SH	
F.5.20	RT STRUCTURE SET	Structure Set Date	(3006,0008)	2	DA	
F.5.20	RT STRUCTURE SET	Structure Set Time	(3006,0009)	2	TM	
F.5.21	RT PLAN	Instance Number	(0020,0013)	1	IS	
F.5.21	RT PLAN	RT Plan Label	(300A,0002)	1	SH	
F.5.21	RT PLAN	RT Plan Date	(300A,0006)	2	DA	
F.5.21	RT PLAN	RT Plan Time	(300A,0007)	2	TM	

A.9.4.3 MR Image Storage

The table shown below lists the fields in the MR Image Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. References in the left-most column are to PS 3.3.

MR Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.1	GENERAL SERIES	Modality	(0008,0060)	1	CS	
C.7.3.1	GENERAL SERIES	Series Instance UID	(0020,000E)	1	UI	
C.7.3.1	GENERAL SERIES	Series Number	(0020,0011)	2	IS	
C.7.3.1	GENERAL SERIES	Patient Position	(0018,5100)	2C	CS	
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.7.4.1	FRAME OF REFERENCE	Frame of Reference UID	(0020,0052)	1	UI	
C.7.4.1	FRAME OF REFERENCE	Position Reference Indicator	(0020,1040)	2	LO	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C.7.6.1	GENERAL IMAGE	Instance Number	(0020,0013)	2	IS	
C.7.6.2	IMAGE PLANE	Pixel Spacing	(0028,0030)	1	DS	Only square pixels supported by ATC

MR Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.6.2	IMAGE PLANE	Image Orientation (Patient)	(0020,0037)	1	DS	
C.7.6.2	IMAGE PLANE	Image Position (Patient)	(0020,0032)	1	DS	
C.7.6.2	IMAGE PLANE	Slice Thickness	(0018,0050)	2	DS	
C.7.6.3	IMAGE PIXEL	Rows	(0028,0010)	1	US	
C.7.6.3	IMAGE PIXEL	Columns	(0028,0011)	1	US	
C.7.6.3	IMAGE PIXEL	Bits Stored	(0028,0101)	1	US	
C.7.6.3	IMAGE PIXEL	High Bit	(0028,0102)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Representation	(0028,0103)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Data	(7FE0,0010)	1	OW/OB	
C.8.3.1	MR IMAGE	Image Type	(0008,0008)	1	CS	See note on ATC recommended usage, below.
C.8.3.1	MR IMAGE (IMAGE PIXEL)	Samples per Pixel	(0028,0002)	1	US	
C.8.3.1	MR IMAGE (IMAGE PIXEL)	Photometric Interpretation	(0028,0004)	1	CS	
C.8.3.1	MR IMAGE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1	US	
C.8.3.1	MR IMAGE	Scanning Sequence	(0018,0020)	1	CS	See note on ATC recommended usage, below
C.8.3.1	MR IMAGE	Sequence Variant	(0018,0021)	1	CS	See note on ATC recommended usage, below
C.8.3.1	MR IMAGE	Scan Options	(0018,0022)	2	CS	
C.8.3.1	MR IMAGE	MR Acquisition Type	(0018,0023)	2	CS	
C.8.3.1	MR IMAGE	Repetition Time	(0018,0080)	2C	DS	
C.8.3.1	MR IMAGE	Echo Time	(0018,0081)	2	DS	
C.8.3.1	MR IMAGE	Echo Train Length	(0018,0091)	2	IS	
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

MR images which are used as the basis of treatment planning, but whose acquisition parameters are not maintained by treatment planning systems may be given an Image Type (0008,0008) value of “DERIVED\SECONDARY\OTHER” to avoid confusion regarding their origin. In such cases, the Scanning Sequence (0018,0020) may be assigned the value “RM” (research mode) and the Sequence Variant (0018,0021) may be assigned “NONE” (no sequence variant).

A.9.4.4 RT Image Storage

The table shown below lists the fields in the RT Image Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. Non-NULL values are required for fields whose Type is specified as 2*. References in the left-most column are to PS 3.3. Please note that this application does not support multi-frame RT IMAGE objects.

RT Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.8.8.1	RT SERIES	Modality	(0008,0060)	1	CS	
C.8.8.1	RT SERIES	Series Instance UID	(0020,000E)	1	UI	
C.8.8.1	RT SERIES	Series Number	(0020,0011)	2	IS	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C.7.6.1	GENERAL IMAGE	Instance Number	(0020,0013)	2	IS	
C.7.6.1	GENERAL IMAGE	Patient Orientation	(0020,0020)	2C	CS	
C.7.6.3	IMAGE PIXEL	Rows	(0028,0010)	1	US	
C.7.6.3	IMAGE PIXEL	Columns	(0028,0011)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Data	(7FE0,0010)	1	OW/OB	
C8.8.2	RT IMAGE (IMAGE PIXEL)	Samples per Pixel	(0028,0002)	1	US	Must be 1 for RT Image.
C8.8.2	RT IMAGE (IMAGE PIXEL)	Photometric Interpretation	(0028,0004)	1	CS	Must be MONOCHROME2 for RT Image.
C8.8.2	RT IMAGE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1	US	Must be 8 or 16 for RT Image.

RT Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C8.8.2	RT IMAGE (IMAGE PIXEL)	Bits Stored	(0028,0101)	1	US	Must be 8 or 12 through 16 for RT Image.
C8.8.2	RT IMAGE (IMAGE PIXEL)	High Bit	(0028,0102)	1	US	One less than Bits Stored (0028,0101)
C8.8.2	RT IMAGE (IMAGE PIXEL)	Pixel Representation	(0028,0103)	1	US	Must be unsigned for RT Image.
C8.8.2	RT IMAGE	RT Image Label	(3002,0002)	1	SH	
C8.8.2	RT IMAGE	Operator's Name	(0008,1070)	2	PN	
C8.8.2	RT IMAGE	Image Type	(0008,0008)	1	CS	
C8.8.2	RT IMAGE	Conversion Type	(0008,0064)	2	CS	
C8.8.2	RT IMAGE	Reported Values Origin	(3002,000A)	2C	CS	
C8.8.2	RT IMAGE	RT Image Plane	(3002,000C)	1	CS	Must be NORMAL for DRRs.
C8.8.2	RT IMAGE	X-Ray Image Receptor Translation	(3002,000D)	3	DS	
C8.8.2	RT IMAGE	X-Ray Image Receptor Angle	(3002,000E)	2*	DS	For DRRs this is normally equal to zero (0) unless the image rotates with the collimators (i.e., beam limiting device) in which case this should be identical to the collimator angle.
C8.8.2	RT IMAGE	RT Image Orientation	(3002,0010)	2C	DS	
C8.8.2	RT IMAGE	Image Plane Pixel Spacing	(3002,0011)	2*	DS	See note below for DRRs
C8.8.2	RT IMAGE	RT Image Position	(3002,0012)	2*	DS	Value required if Image Type (0008,0008) is DRR and image is not centered on central ray.
C8.8.2	RT IMAGE	Radiation Machine Name	(3002,0020)	2	SH	
C8.8.2	RT IMAGE	Primary Dosimeter Unit	(300A,00B3)	2	CS	
C8.8.2	RT IMAGE	Radiation Machine SAD	(3002,0022)	2	DS	
C8.8.2	RT IMAGE	RT Image SID	(3002,0026)	2*	DS	See note below for DRRs
C8.8.2	RT IMAGE	Referenced RT Plan Sequence	(300C,0002)	3	SQ	Value required if Image Type (0008,0008) is DRR or PORTAL.
C8.8.2	RT IMAGE	>Referenced SOP Class UID	(0008,1150)	1C	UI	
C8.8.2	RT IMAGE	>Referenced SOP Instance UID	(0008,1155)	1C	UI	
C8.8.2	RT IMAGE	Referenced Beam Number	(300C,0006)	3	IS	Value required if Image Type (0008,0008) is DRR or PORTAL.
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

In order to determine the scale of DRR images either (preferably) the Image Plane Pixel Spacing (3002,0011) and RT Image SID (3002,0026) attributes must both be specified, or some scale must be "burned in" to the image (e.g. the port shape or graticule).

A.9.4.5 RT Dose Storage

The table shown below lists the fields in the RT Dose Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. References in the left-most column are to PS 3.3.

If an RT Dose object is part of a file set, any RT Plan and Structure Set object(s) whose Instance UIDs are referenced by the RT Dose object must also be present in the file set.

RT Dose IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.8.8.1	RT SERIES	Modality	(0008,0060)	1	CS	
C.8.8.1	RT SERIES	Series Instance UID	(0020,000E)	1	UI	
C.8.8.1	RT SERIES	Series Number	(0020,0011)	2	IS	
C.7.4.1	FRAME OF REFERENCE	Frame of Reference UID	(0020,0052)	1	UI	
C.7.4.1	FRAME OF REFERENCE	Position Reference Indicator	(0020,1040)	2	LO	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	RTP System Manufacturer
C.7.6.1	GENERAL IMAGE	Instance Number	(0020,0013)	2	IS	

RT Dose IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.6.2	IMAGE PLANE	Pixel Spacing	(0028,0030)	1	DS	
C.7.6.2	IMAGE PLANE	Image Orientation (Patient)	(0020,0037)	1	DS	
C.7.6.2	IMAGE PLANE	Image Position (Patient)	(0020,0032)	1	DS	
C.7.6.2	IMAGE PLANE	Slice Thickness	(0018,0050)	2	DS	Ignored for Multi-frame information (0028, 0009) and (3004,000C)
C.7.6.3	IMAGE PIXEL	Rows	(0028,0010)	1	US	
C.7.6.3	IMAGE PIXEL	Columns	(0028,0011)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Data	(7FE0,0010)	1	OW/OB	
C.7.6.6	MULTI-FRAME	Number of Frames	(0028,0008)	1	IS	
C.7.6.6	MULTI-FRAME	Frame Increment Pointer	(0028,0009)	1	AT	Must contain the Grid Frame Offset Vector tag (3004, 000C)
C.8.8.3	RT DOSE (IMAGE PIXEL)	Samples per Pixel	(0028,0002)	1C	US	
C.8.8.3	RT DOSE (IMAGE PIXEL)	Photometric Interpretation	(0028,0004)	1C	CS	
C.8.8.3	RT DOSE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1C	US	
C.8.8.3	RT DOSE (IMAGE PIXEL)	Bits Stored	(0028,0101)	1C	US	
C.8.8.3	RT DOSE (IMAGE PIXEL)	High Bit	(0028,0102)	1C	US	
C.8.8.3	RT DOSE (IMAGE PIXEL)	Pixel Representation	(0028,0103)	1C	US	
C.8.8.3	RT DOSE	Dose Units	(3004,0002)	1	CS	Only GY supported by ATC.
C.8.8.3	RT DOSE	Dose Type	(3004,0004)	1	CS	ATC only supports physical dose and adds the following defined terms: PHYSICAL_HETERO = physical dose computed with heterogeneity correction (i.e., image-derived tissue density); PHYSICAL_HOMO = physical dose computed without heterogeneity correction (i.e., assuming water density)
C.8.8.3	RT DOSE	Dose Summation Type	(3004,000A)	1	CS	ATC supports FRACTION and PLAN and adds the terms TOTALHOMO and TOTALHETERO (see note below)
C.8.8.3	RT DOSE	Referenced RT Plan Sequence	(300C,0002)	1C	SQ	Dose must reference either FRACTION or PLAN. If Dose Summation Type (3004,000A) is TOTALHOMO or TOTALHETERO, this sequence is excluded. The sub-sequences for beam and brachy application setup should not be present.
C.8.8.3	RT DOSE	>Referenced SOP Class UID	(0008,1150)	1C	UI	

RT Dose IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.3	RT DOSE	>Referenced SOP Instance UID	(0008,1155)	1C	UI	
C.8.8.3	RT DOSE	>Referenced Fraction Group Sequence	(300C,0020)	1C	SQ	
C.8.8.3	RT DOSE	>>Referenced Fraction Group Number	(300C,0022)	1C	IS	
C.8.8.3	RT DOSE	Grid Frame Offset Vector	(3004,000C)	1C	DS	Only monotonic offsets are supported The values in the vector are considered relative to "Image Position (Patient)" (0020,0032); however, if "Image Orientation (Patient)" is [1,0,0, 0,1,0] (non-rotated) AND the first value in the vector is NOT zero (0.0), then the Z-values are considered to be Z coordinate values in patient space (for compatibility with prior implementations).
C.8.8.3	RT DOSE	Dose Grid Scaling	(3004,000E)	1	DS	Must convert to GY.
C.8.8.4	RT DVH	Referenced Structure Set Sequence	(300C,0060)	1	SQ	
C.8.8.4	RT DVH	>Referenced SOP Class UID	(0008,1150)	1	UI	
C.8.8.4	RT DVH	>Referenced SOP Instance UID	(0008,1155)	1	UI	
C.8.8.4	RT DVH	DVH Sequence	(3004,0050)	1	SQ	
C.8.8.4	RT DVH	>DVH Referenced ROI Sequence	(3004,0060)	1	SQ	
C.8.8.4	RT DVH	>>Referenced ROI Number	(3006,0084)	1	IS	
C.8.8.4	RT DVH	>>DVH ROI Contribution Type	(3004,0062)	1	CS	
C.8.8.4	RT DVH	>DVH Type	(3004,0001)	1	CS	
C.8.8.4	RT DVH	>Dose Units	(3004,0002)	1	CS	Must be GY.
C.8.8.4	RT DVH	>Dose Type	(3004,0004)	1	CS	See comment for Dose Type (3004,0004) in RT Dose module above
C.8.8.4	RT DVH	>DVH Dose Scaling	(3004,0052)	1	DS	Must convert to GY.
C.8.8.4	RT DVH	>DVH Volume Units	(3004,0054)	1	CS	Must be CM3 (PERCENT not supported by ATC).
C.8.8.4	RT DVH	>Number of Bins	(3004,0056)	1	IS	
C.8.8.4	RT DVH	>DVH Data	(3004,0058)	1	DS	Note that the dose is specified as bin widths (which sum over each bin to yield the bin dose value) and not as the bin dose.
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

Dose matrices are required for each FRACTION GROUP (external or brachy), DVHs required for each total RT Plan. If the total dose DVHs refer to an RT Plan which is not provided, Dose Summation Type must be one of the following terms: TOTALHOMO = DVHs computed for total plan dose without heterogeneity correction, or TOTALHETERO = DVHs computed for total plan dose with heterogeneity correction.

A.9.4.6 RT Structure Set Storage

The table shown below lists the fields in the RT Structure Set Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. Non-NULL values are required for fields whose Type is specified as 2*. References in the left-most column are to PS 3.3.

If a Structure Set object is part of a file set, the Image object(s), if any, whose Frame of Reference UID is referenced by the Structure Set must also be present in the file set. Structures must conform to the following conditions:

1. Structure Set contours must be of type CLOSED_PLANAR.
2. Structure Set contours must be defined in transverse planes, which coincide with image planes of the Image object(s) in the referenced Frame of Reference.

RT Structure Set IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	

RT Structure Set IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.1	RT SERIES	Modality	(0008,0060)	1	CS	
C.8.8.1	RT SERIES	Series Instance UID	(0020,000E)	1	UI	
C.8.8.1	RT SERIES	Series Number	(0020,0011)	2	IS	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C.8.8.5	STRUCTURE SET	Structure Set Label	(3006,0002)	1	SH	
C.8.8.5	STRUCTURE SET	Structure Set Date	(3006,0008)	2	DA	
C.8.8.5	STRUCTURE SET	Structure Set Time	(3006,0009)	2	TM	
C.8.8.5	STRUCTURE SET	Referenced Frame of Reference Sequence	(3006,0010)	3	SQ	Required for resolution of Referenced Frame of Reference UID (3006,0024) This sequence shall contain exactly one item.
C.8.8.5	STRUCTURE SET	>Frame of Reference UID	(0020,0052)	1C	UI	
C.8.8.5	STRUCTURE SET	Structure Set ROI Sequence	(3006,0020)	3	SQ	Required to provide structure set data
C.8.8.5	STRUCTURE SET	>ROI Number	(3006,0022)	1C	IS	
C.8.8.5	STRUCTURE SET	>Referenced Frame of Reference UID	(3006,0024)	1C	UI	Should be the same as Frame of Reference UID (0020,0052) above
C.8.8.5	STRUCTURE SET	>ROI Name	(3006,0026)	2C*	LO	Required to identify ROI's as named by user.
C.8.8.5	STRUCTURE SET	>ROI Generation Algorithm	(3006,0036)	2C	CS	
C.8.8.6	ROI CONTOUR	ROI Contour Sequence	(3006,0039)	1	SQ	
C.8.8.6	ROI CONTOUR	>Referenced ROI Number	(3006,0084)	1	IS	
C.8.8.6	ROI CONTOUR	>Contour Sequence	(3006,0040)	3	SQ	Introduces a Sequence of Contours for a given ROI
C.8.8.6	ROI CONTOUR	>>Contour Geometric Type	(3006,0042)	1C	CS	Must be CLOSED_PLANAR or POINT. CLOSED_PLANAR = closed contour (polygon) containing coplanar points. The first point of contour is not repeated (i.e., closing is implied). POINT = point of interest, e.g., isocenter, dose specification point.
C.8.8.6	ROI CONTOUR	>>Number of Contour Points	(3006,0046)	1C	IS	
C.8.8.6	ROI CONTOUR	>>Contour Data	(3006,0050)	1C	DS	
C.8.8.8	ROI Observations	RT ROI Observations Sequence	(3006,0080)	1	SQ	
C.8.8.8	ROI Observations	>Observation Number	(3006,0082)	1	IS	
C.8.8.8	ROI Observations	>Referenced ROI Number	(3006,0084)	1	IS	
C.8.8.8	ROI Observations	>ROI Observation Label	(3006,0085)	3	SH	If ROI Name (3006,0026) is NULL and this attribute is provided, ATC will use it as the structure name

RT Structure Set IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.8	ROI Observations	>RT ROI Interpreted Type	(3006,00A4)	2	CS	Will be used by ATC to classify ROI, if provided.
C.8.8.8	ROI Observations	>ROI Interpreter	(3006,00A6)	2	PN	
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

A.9.4.7 RT Plan Storage

The table shown below lists the fields in the RT Plan Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. Non-NULL values are required for fields whose Type is specified as 2*. References in the left-most column are to PS 3.3.

If an RT Plan object is part of a file set, the Structure Set object(s) whose Instance UIDs are referenced by the RT Plan must also be present in the file set. The File Set Reader application currently supports clinical-trial protocols for Transperineal Interstitial Permanent Prostate Brachytherapy (TIPPB). The reader will also support protocols for High Dose Rate (HDR) and Low Dose Rate (LDR) brachytherapy in the near future.

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.8.8.1	RT SERIES	Modality	(0008,0060)	1	CS	
C.8.8.1	RT SERIES	Series Instance UID	(0020,000E)	1	UI	
C.8.8.1	RT SERIES	Series Number	(0020,0011)	2	IS	
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C8.8.9	RT GENERAL PLAN	RT Plan Label	(300A,0002)	1	SH	
C8.8.9	RT GENERAL PLAN	Operators' Name	(0008,1070)	2	PN	
C8.8.9	RT GENERAL PLAN	RT Plan Date	(300A,0006)	2	DA	
C8.8.9	RT GENERAL PLAN	RT Plan Time	(300A,0007)	2	TM	
C8.8.9	RT GENERAL PLAN	RT Plan Geometry	(300A,000C)	1	CS	Must be PATIENT
C8.8.9	RT GENERAL PLAN	Referenced Structure Set Sequence	(300C,0060)	1C	SQ	Required since DICOM condition is forced
C8.8.9	RT GENERAL PLAN	>Referenced SOP Class UID	(0008,1150)	1C	UI	Required since DICOM condition is forced
C8.8.9	RT GENERAL PLAN	>Referenced SOP Instance UID	(0008,1155)	1C	UI	Required since DICOM condition is forced
C.8.8.13	RT FRACTION SCHEME	Fraction Group Sequence	(300A,0070)	1	SQ	
C.8.8.13	RT FRACTION SCHEME	>Fraction Group Number	(300A,0071)	1	IS	
C.8.8.13	RT FRACTION SCHEME	>Number of Fractions Planned	(300A,0078)	2*	IS	Must be specified (non-null)
C.8.8.13	RT FRACTION SCHEME	>Number of Beams	(300A,0080)	1	IS	
C.8.8.13	RT FRACTION SCHEME	>Referenced Beam Sequence	(300C,0004)	1C	SQ	
C.8.8.13	RT FRACTION SCHEME	>>Referenced Beam Number	(300C,0006)	1C	IS	
C.8.8.13	RT FRACTION SCHEME	>>Beam Dose Specification Point	(300A,0082)	3	DS	Requested by ATC
C.8.8.13	RT FRACTION SCHEME	>>Beam Dose	(300A,0084)	3	DS	Requested by ATC Beam Dose in Gy (per fraction).
C.8.8.13	RT FRACTION SCHEME	>>Beam Meterset	(300A,0086)	3	DS	Required by ATC
C.8.8.13	RT FRACTION SCHEME	>Number of Brachy Application Setups	(300A,00A0)	1	IS	
C.8.8.13	RT FRACTION SCHEME	>Referenced Brachy Application Setup Sequence	(300C,000A)	1C	SQ	
C.8.8.13	RT FRACTION SCHEME	>>Referenced Brachy Application Setup Number	(300C,000C)	1C	IS	
C.8.8.14	RT Beams	Beam Sequence	(300A,00B0)	1	SQ	
C.8.8.14	RT Beams	>Beam Number	(300A,00C0)	1	IS	
C.8.8.14	RT Beams	>Beam Name	(300A,00C2)	3	LO	Required if (300A,00C3) not present
C.8.8.14	RT Beams	>Beam Description	(300A,00C3)	3	ST	Required if (300A,00C2) not present

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.14	RT Beams	>Beam Type	(300A,00C4)	1	CS	
C.8.8.14	RT Beams	>Radiation Type	(300A,00C6)	2*	CS	Must be specified (non-null)
C.8.8.14	RT Beams	>Treatment Machine Name	(300A,00B2)	2	SH	
C.8.8.14	RT Beams	>Source-Axis Distance	(300A,00B4)	3	DS	Required by ATC
C.8.8.14	RT Beams	>Beam Limiting Device Sequence	(300A,00B6)	1	SQ	
C.8.8.14	RT Beams	>>RT Beam Limiting Device Type	(300A,00B8)	1	CS	
C.8.8.14	RT Beams	>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	IS	
C.8.8.14	RT Beams	>>Leaf Position Boundaries	(300A,00BE)	2C*	DS	Must be specified (non-null) if condition met, i.e., if Beam Limiting Device Type is MLC
C.8.8.14	RT Beams	>Number of Wedges	(300A,00D0)	1	IS	
C.8.8.14	RT Beams	>Wedge Sequence	(300A,00D1)	1C	SQ	
C.8.8.14	RT Beams	>>Wedge Number	(300A,00D2)	1C	IS	
C.8.8.14	RT Beams	>>Wedge Type	(300A,00D3)	2C	CS	
C.8.8.14	RT Beams	>>Wedge Angle	(300A,00D5)	2C*	IS	Must be specified (non-null)
C.8.8.14	RT Beams	>>Wedge Factor	(300A,00D6)	2C	DS	
C.8.8.14	RT Beams	>>Wedge Orientation	(300A,00D8)	2C*	DS	Must be specified (non-null)
C.8.8.14	RT Beams	>Number of Compensators	(300A,00E0)	1	IS	
C.8.8.14	RT Beams	>Compensator Sequence	(300A,00E3)	1C	SQ	
C.8.8.14	RT Beams	>>Compensator Number	(300A,00E4)	1C	IS	
C.8.8.14	RT Beams	>>Material ID	(300A,00E1)	2C	SH	
C.8.8.14	RT Beams	>>Source to Compensator Tray Distance	(300A,00E6)	2C	DS	
C.8.8.14	RT Beams	>>Compensator Rows	(300A,00E7)	1C	IS	
C.8.8.14	RT Beams	>>Compensator Columns	(300A,00E8)	1C	IS	
C.8.8.14	RT Beams	>>Compensator Pixel Spacing	(300A,00E9)	1C	DS	
C.8.8.14	RT Beams	>>Compensator Position	(300A,00EA)	1C	DS	
C.8.8.14	RT Beams	>>Compensator Transmission Data	(300A,00EB)	1C	DS	
C.8.8.14	RT Beams	>>Compensator Thickness Data	(300A,00EC)	1C	DS	
C.8.8.14	RT Beams	>>Source to Compensator Distance	(300A,02E2)	1C	DS	
C.8.8.14	RT Beams	>Number of Boli	(300A,00ED)	1	IS	
C.8.8.14	RT Beams	>Referenced Bolus Sequence	(300C,00B0)	1C	SQ	
C.8.8.14	RT Beams	>>Referenced ROI Number	(3006,0084)	1C	IS	

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.14	RT Beams	>Number of Blocks	(300A,00F0)	1	IS	
C.8.8.14	RT Beams	>Block Sequence	(300A,00F4)	1C	SQ	
C.8.8.14	RT Beams	>>Source to Block Tray Distance	(300A,00F6)	2C	DS	
C.8.8.14	RT Beams	>>Block Type	(300A,00F8)	1C	CS	
C.8.8.14	RT Beams	>>Block Divergence	(300A,00FA)	2C	CS	
C.8.8.14	RT Beams	>>Block Number	(300A,00FC)	1C	IS	
C.8.8.14	RT Beams	>>Material ID	(300A,00E1)	2C	SH	
C.8.8.14	RT Beams	>>Block Thickness	(300A,0100)	2C	DS	
C.8.8.14	RT Beams	>>Block Transmission	(300A,0102)	2C	DS	
C.8.8.14	RT Beams	>>Block Number of Points	(300A,0104)	2C*	IS	Must be specified (non-null)
C.8.8.14	RT Beams	>>Block Data	(300A,0106)	2C*	DS	Must be specified (non-null)
C.8.8.14	RT Beams	>Final Cumulative Meterset Weight	(300A,010E)	1C	DS	
C.8.8.14	RT Beams	>Number of Control Points	(300A,0110)	1	IS	
C.8.8.14	RT Beams	>Control Point Sequence	(300A,0111)	1	SQ	
C.8.8.14	RT Beams	>>Control Point Index	(300A,0112)	1C	IS	
C.8.8.14	RT Beams	>>Cumulative Meterset Weight	(300A,0134)	2C*	DS	Must be specified (non-null)
C.8.8.14	RT Beams	>>Nominal Beam Energy	(300A,0114)	3	DS	Required by ATC
C.8.8.14	RT Beams	>>Beam Limiting Device Position Sequence	(300A,011A)	1C	SQ	
C.8.8.14	RT Beams	>>>RT Beam Limiting Device Type	(300A,00B8)	1C	CS	
C.8.8.14	RT Beams	>>>Leaf/Jaw Positions	(300A,011C)	1C	DS	
C.8.8.14	RT Beams	>>Gantry Angle	(300A,011E)	1C	DS	
C.8.8.14	RT Beams	>>Gantry Rotation Direction	(300A,011F)	1C	CS	
C.8.8.14	RT Beams	>>Beam Limiting Device Angle	(300A,0120)	1C	DS	
C.8.8.14	RT Beams	>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	CS	
C.8.8.14	RT Beams	>>Patient Support Angle	(300A,0122)	1C	DS	
C.8.8.14	RT Beams	>>Patient Support Rotation Direction	(300A,0123)	1C	CS	
C.8.8.14	RT Beams	>>Table Top Eccentric Angle	(300A,0125)	1C	DS	
C.8.8.14	RT Beams	>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	CS	
C.8.8.14	RT Beams	>>Table Top Vertical Position	(300A,0128)	2C	DS	

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.14	RT Beams	>>Table Top Longitudinal Position	(300A,0129)	2C	DS	
C.8.8.14	RT Beams	>>Table Top Lateral Position	(300A,012A)	2C	DS	
C.8.8.14	RT Beams	>>Isocenter Position	(300A,012C)	2C*	DS	Must be specified (non-null)
C.8.8.15	RT Brachy Application Setups	Brachy Treatment Technique	(300A,0200)	1	CS	"PERMANENT" for TIPPB
C.8.8.15	RT Brachy Application Setups	Brachy Treatment Type	(300A,0202)	1	CS	"HDR" for HDR, "LDR" for LDR
C.8.8.15	RT Brachy Application Setups	Treatment Machine Sequence	(300A,0206)	1	SQ	
C.8.8.15	RT Brachy Application Setups	>Treatment Machine Name	(300A,00B2)	2	SH	
C.8.8.15	RT Brachy Application Setups	Source Sequence	(300A,0210)	1	SQ	
C.8.8.15	RT Brachy Application Setups	>Source Number	(300A,0212)	1	IS	
C.8.8.15	RT Brachy Application Setups	>Source Type	(300A,0214)	1	CS	Note: POINT is the expected type for TIPPB
C.8.8.15	RT Brachy Application Setups	>Source Isotope Name	(300A,0226)	1	LO	
C.8.8.15	RT Brachy Application Setups	>Source Isotope Half Life	(300A,0228)	1	DS	
C.8.8.15	RT Brachy Application Setups	>Reference Air Kerma Rate	(300A,022A)	1	DS	
C.8.8.15	RT Brachy Application Setups	>Air Kerma Rate Reference Date	(300A,022C)	1	DA	Must be date of Implant for TIPPB
C.8.8.15	RT Brachy Application Setups	>Air Kerma Rate Reference Time	(300A,022E)	1	TM	Must be time of Implant for TIPPB
C.8.8.15	RT Brachy Application Setups	Application Setup Sequence	(300A,0230)	1	SQ	One per seed for TIPPB
C.8.8.15	RT Brachy Application Setups	>Application Setup Type	(300A,0232)	1	CS	
C.8.8.15	RT Brachy Application Setups	>Application Setup Number	(300A,0234)	1	IS	
C.8.8.15	RT Brachy Application Setups	>Total Reference Air Kerma	(300A,0250)	1	DS	
C.8.8.15	RT Brachy Application Setups	>Channel Sequence	(300A,0280)	1	SQ	Note: Exactly one per application setup for TIPPB
C.8.8.15	RT Brachy Application Setups	>>Channel Number	(300A,0282)	1	IS	
C.8.8.15	RT Brachy Application Setups	>>Channel Length	(300A,0284)	2	DS	
C.8.8.15	RT Brachy Application Setups	>>Channel Total Time	(300A,0286)	1	DS	See note C.8.8.15.1 (Mean Lifetime of isotope for TIPPB).
C.8.8.15	RT Brachy Application Setups	>>Source Movement Type	(300A,0288)	1	CS	FIXED for TIPPB
C.8.8.15	RT Brachy Application Setups	>>Transfer Tube Number	(300A,02A2)	2	IS	
C.8.8.15	RT Brachy Application Setups	>>Transfer Tube Length	(300A,02A4)	2C	DS	
C.8.8.15	RT Brachy Application Setups	>>Referenced Source Number	(300C,000E)	1	IS	
C.8.8.15	RT Brachy Application Setups	>>Number of Control Points	(300A,0110)	1	IS	
C.8.8.15	RT Brachy Application Setups	>>Final Cumulative Time Weight	(300A,02C8)	1C	DS	
C.8.8.15	RT Brachy Application Setups	>>Brachy Control Point Sequence	(300A,02D0)	1	SQ	
C.8.8.15	RT Brachy Application Setups	>>>Control Point Index	(300A,0112)	1	IS	

RT Plan IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.8.15	RT Brachy Application Setups	>>>Cumulative Time Weight	(300A,02D6)	2*	DS	Must be specified (non-null)
C.8.8.15	RT Brachy Application Setups	>>>Control Point Relative Position	(300A,02D2)	1	DS	
C.8.8.15	RT Brachy Application Setups	>>>Control Point 3D Position	(300A,02D4)	3	DS	Required by ATC. This is the (x,y,z) location of the seed or dwell point in patient coordinates.
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

A.9.4.8 Ultrasound Image Storage

The table shown below lists the fields in the Ultrasound Image Storage SOP Class, which are read by this application. Unlisted fields are not used by this application. Special considerations in the usage of fields are noted in the Comments column. References in the left-most column are to PS 3.3.

US Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.1.1	PATIENT	Patient's Name	(0010,0010)	2*	PN	See A.9.2.1
C.7.1.1	PATIENT	Patient ID	(0010,0020)	2*	LO	See A.9.2.1
C.7.1.1	PATIENT	Patient's Birth Date	(0010,0030)	2	DA	
C.7.1.1	PATIENT	Patient's Sex	(0010,0040)	2	CS	
C.7.1.2	GENERAL STUDY	Study Instance UID	(0020,000D)	1	UI	
C.7.1.2	GENERAL STUDY	Study Date	(0008,0020)	2	DA	
C.7.1.2	GENERAL STUDY	Study Time	(0008,0030)	2	TM	
C.7.1.2	GENERAL STUDY	Referring Physician's Name	(0008,0090)	2	PN	
C.7.1.2	GENERAL STUDY	Study ID	(0020,0010)	2	SH	
C.7.1.2	GENERAL STUDY	Accession Number	(0008,0050)	2	SH	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Sponsor Name	(0012,0010)	1	LO	"RTOG", "NSABP", "COG", "PBTC", etc.
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol ID	(0012,0020)	1	LO	Sponsor-defined protocol number/ID
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Protocol Name	(0012,0021)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site ID	(0012,0030)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Site Name	(0012,0031)	2	LO	
C.7.1.3	CLINICAL TRIAL SUBJECT	Clinical Trial Subject ID	(0012,0040)	1C	LO	Case number, always required
C.7.2.3	CLINICAL TRIAL STUDY	Clinical Trial Time Point ID	(0012,0050)	2	LO	As defined by clinical protocol
C.7.3.1	GENERAL SERIES	Modality	(0008,0060)	1	CS	
C.7.3.1	GENERAL SERIES	Series Instance UID	(0020,000E)	1	UI	
C.7.3.1	GENERAL SERIES	Series Number	(0020,0011)	2	IS	

US Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.7.3.2	CLINICAL TRIAL SERIES	Clinical Trial Coordinating Center Name	(0012,0060)	2	LO	
C.7.4.1	FRAME OF REFERENCE	Frame of Reference UID	(0020,0052)	1	UI	
C.7.4.1	FRAME OF REFERENCE	Position Reference Indicator	(0020,1040)	2	LO	
C.8.5.4	US FRAME OF REFERENCE	Region Location Min x 0	(0018,6018)	1	UL	0 expected; value ignored
C.8.5.4	US FRAME OF REFERENCE	Region Location Min y 0	(0018,601A)	1	UL	0 expected; value ignored
C.8.5.4	US FRAME OF REFERENCE	Region Location Max x 1	(0018,601C)	1	UL	"Columns" -1 expected; value ignored
C.8.5.4	US FRAME OF REFERENCE	Region Location Max y 1	(0018,601E)	1	UL	"Rows" -1 expected; value ignored
C.8.5.4	US FRAME OF REFERENCE	Physical Units X Direction	(0018,6024)	1	US	Must be "0003H" meaning cm
C.8.5.4	US FRAME OF REFERENCE	Physical Units Y Direction	(0018,6026)	1	US	Must be "0003H" meaning cm
C.8.5.4	US FRAME OF REFERENCE	Physical Delta X	(0018,602C)	1	FD	X pixel size in cm Square pixels currently supported by ATC. Non-Square pixels will be supported.
C.8.5.4	US FRAME OF REFERENCE	Physical Delta Y	(0018,602E)	1	FD	Y pixel size in cm Square pixels currently supported by ATC. Non-Square pixels will be supported.
C.8.5.4	US FRAME OF REFERENCE	Reference Pixel x0	(0018,6020)	3	SL	Required by ATC x0 = 0 assumed if not present
C.8.5.4	US FRAME OF REFERENCE	Reference Pixel y0	(0018,6022)	3	SL	Required by ATC y0 = 0 assumed if not present
C.7.5.1	GENERAL EQUIPMENT	Manufacturer	(0008,0070)	2	LO	
C.7.6.1	GENERAL IMAGE	Instance Number	(0020,0013)	2	IS	
C.7.6.1	GENERAL IMAGE	Patient Orientation	(0020,0020)	2C	CS	
C.7.6.3	IMAGE PIXEL	Rows	(0028,0010)	1	US	
C.7.6.3	IMAGE PIXEL	Columns	(0028,0011)	1	US	
C.7.6.3	IMAGE PIXEL	Pixel Aspect Ratio	(0028,0034)	1C	IS	
C.7.6.3	IMAGE PIXEL	Pixel Data	(7FE0,0010)	1	OW/OB	
C.8.5.6	US IMAGE (IMAGE PIXEL)	Samples per Pixel	(0028,0002)	1	US	
C.8.5.6	US IMAGE (IMAGE PIXEL)	Photometric Interpretation	(0028,0004)	1	CS	
C.8.5.6	US IMAGE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1	US	
C.8.5.6	US IMAGE (IMAGE PIXEL)	Bits Stored	(0028,0101)	1	US	
C.8.5.6	US IMAGE (IMAGE PIXEL)	High Bit	(0028,0102)	1	US	
C.8.5.6	US IMAGE (IMAGE PIXEL)	Pixel Representation	(0028,0103)	1	US	
C.8.5.6	US IMAGE	Image Type	(0008,0008)	2	CS	
C.8.5.6	US IMAGE	Image Transformation Matrix	(0018,5210)	3	DS	Required by ATC. [1, 0, 0] [0, -1, 0] for supine viewed from foot

US Image IOD						
Ref #	DICOM Module	Attribute Name	Tag	Type	VR	Comments
C.8.5.6	US IMAGE	Image Translation Vector	(0018,5212)	3	DS	Required by ATC. [Xt, Yt, Zt] (in mm) translates the reference pixel to patient space. See (0018,6020) and (0018,6022)
C.12.1	SOP COMMON	SOP Class UID	(0008,0016)	1	UI	
C.12.1	SOP COMMON	SOP Instance UID	(0008,0018)	1	UI	

A.9.6 Private Transfer Syntaxes

No private transfer syntaxes are supported by this application.