GE Healthcare

Technical Publications

Direction 5411774-100
Revision 1

AdvantageSim MD 8

DICOM CONFORMANCE STATEMENT

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IMPORTANT PRECAUTIONS

LANGUAGE

ПРЕДУПРЕЖДЕНИЕ (BG)	Това упътване за работа е налично само на английски език. • Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод. • Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа. • Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациента в резултат на токов удар, механична или друга опасност.
警告 (ZH-CN)	本维修手册仅提供英文版本。 • 如果客户的维修服务人员需要非英文版本，则客户需自行提供翻译服务。 • 未详细阅读和完全理解本维修手册之前，不得进行维修。 • 忽略本警告可能对维修服务人员、操作人员或患者造成电击、机械伤害或其他形式的伤 害。
警告 (ZH-HK)	本服務手冊僅提供英文版本。 • 倘若客戶的服務供應商需要英文以外之服務手冊，客戶有責任提供翻譯服務。 • 除非已參閱本服務手冊及明白其內容，否則切勿嘗試維修設備。 • 不遵從本警告或會令服務供應商、網絡供應商或病人受到觸電、機械性或其他的危險。
警告 (ZH-TW)	本維修手冊僅有英文版。 • 若客戶的維修廠商需要英文版以外的語言，應由客戶自行提供翻譯服務。 • 請勿試圖維修本設備，除非 您已查閱並瞭解本維修手冊。 • 若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。
UPOZORENJE (HR)	Ovaj servisni priručnik dostupan je na engleskom jeziku. • Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod. • Ne pokušavajte servisirati opremu ako niste u potpunosti pročitali i razumjeli ovaj servisni priručnik. • Zanemarite li ovo upozorenje, može doći do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehaničkih ili drugih rizika.

VÝSTRAHA (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret uden at læse og forstå denne servicemanual. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WAARSCHUWING (NL)	Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar. • Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
WARNING (EN)	This service manual is available in English only. • If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services. • Do not attempt to service the equipment unless this service manual has been consulted and is understood. • Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

HOIATUS (ET)	See teenindusjuhend on saadaval ainult inglise keeles. • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.
VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
ATTENTION (FR)	Ce manuel d'installation et de maintenance est disponible uniquement en anglais. • Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire. • Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance n'a pas été consulté et compris. • Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.
WARNUNG (DE)	Diese Serviceanleitung existiert nur in englischer Sprache. • Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen. • Versuchen Sie nicht diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.

ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται μόνο στα αγγλικά. • Εάν ο τεχνικός σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει τις υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό αν δεν έχετε συμβουλευτεί και κατανοήσει το παρόν εγχειρίδιο σέρβις. • Αν δεν προσέξετε την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στον τεχνικό σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
FIGYELMEZTETÉS (HU)	Ezen karbantartási kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése. • Ne próbálja elkezdeni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték. • Ezen figyelmeztetés figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.
AÐVÖRUN (IS)	Þessi þjónustuhandbók er aðeins fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in lingua inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.

警告 (JA)	このサービスマニュアルには英語版しかありません。 • サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。 • このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないでください。 • この警告に従わない場合、サービスを担当される方、操作員あるいは患者 さんが、感電や機械的又はその他の危険により負傷する可能性があります。
경고 (KO)	본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다. • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다. • 본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오. • 본 경고 사항에 유의하지 않으면 전기 쇼크, 기계적 위험, 또는 기타 위험으로 인해 서비스 제공자, 사용자 또는 환자에게 부상을 입힐 수 있습니다.
BRĪDINĀJUMS (LV)	Šī apkopes rokasgrāmata ir pieejama tikai angļu valodā. • Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu. • Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas. • Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.
ĮSPĖJIMAS (LT)	Šis eksploatavimo vadovas yra tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas privalo klientas. • Nemėginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploatavimo vadovo. • Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų.

ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.
OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go. • Niezastosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.
ATENÇÃO (PT-BR)	Este manual de assistência técnica encontra-se disponível unicamente em inglês. • Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.
ATENÇÃO (PT-PT)	Este manual de assistência técnica só se encontra disponível em inglês. • Se qualquer outro serviço de assistência técnica solicitar este manual noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode colocar em perigo a segurança do técnico, do operador ou do paciente devido a choques eléctricos, mecânicos ou outros.

ATENȚIE (RO)	Acest manual de service este disponibil doar în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării şi înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ОСТОРОЖНО! (RU)	Данное руководство по техническому обслуживанию представлено только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует самостоятельно обеспечить перевод. • Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.
UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. • Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge. • Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo. • Zanemarivanje ovog upozorenja može dovesti do povređivanja servisera, rukovaoca ili pacijenta usled strujnog udara ili mehaničkih i drugih opasnosti.
UPOZORNENIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka. • Nepokúšajte sa o obsluhu zariadenia, kým si neprečítate návod na obluhu a neporozumiete mu. • Zanedbanie tohto upozornenia môže spôsobiť zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.

ATENCION (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio. • La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.
VARNING (SV)	Den här servicehandboken finns bara tillgänglig på engelska. • Om en kunds servicetekniker har behov av ett annat språk än engelska, ansvarar kunden för att tillhandahålla översättningstjänster. • Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken. • Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.
OPOZORILO (SL)	Ta servisni priročnik je na voljo samo v angleškem jeziku. • Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod. • Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli. • Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.
DİKKAT (TR)	Bu servis kılavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kılavuzu ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

CONFORMANCE STATEMENT OVERVIEW

AdvantageSim MD is virtual treatment simulation software. It uses CT, PET and MR Image Storage for planning a treatment and as a result it provides RT Plan, RT Structure Set, RT Image and Secondary Capture Image Storage for further processing. AdvantageSim MD does not provide intrinsic implementation of DICOM Network instead uses application interface of its platforms called Advantage Workstation and AW Server.

Table 0.1 provides an overview of the network services supported by AdvantageSim MD.

TABLE 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
CT Image Storage	No	Yes
MR Image Storage	No	Option*
Positron Emission Tomography Image Storage	No	Option*
Secondary Capture Image Storage	Yes	No
RT Image Storage	Yes	No
RT Structure Set Storage	Yes	Yes
RT Plan Storage	Yes	Yes

Note: Option*: This means that this service can be purchased separately

TABLE OF CONTENTS

1 INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

SECTION 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

SECTION 2 (Network Conformance Statement), which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

SECTION 3 (CT Information Object Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a CT Image Information Object.

SECTION 4 (MR Information Object Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a MR Image Information Object.

SECTION 5 (PET Information Object Implementation) , which specifies the GEHC equipment compliance to DICOM requirements for the implementation of a PET Image Information Object.

SECTION 6 (SECONDARY CAPTURE Information Object Implementation), which defines the GEHC equipment compliance to DICOM requirements for the implementation of a Secondary Capture information object generated by AdvantageSim.

SECTION 7 (RT IMAGE Information Object Implementation), which defines the GEHC equipment compliance to DICOM requirements for the implementation of an RT Image information object generated by AdvantageSim.

SECTION 8 (RT STRUCTURE SET Information Object Implementation), which defines the GEHC equipment compliance to DICOM requirements for the implementation of an RT Structure Set information object generated by AdvantageSim, and the requirements for RT Structure Set objects imported into AdvantageSim.

SECTION 9 (RT PLAN Information Object Implementation), which defines the GEHC equipment compliance to DICOM requirements for the implementation of an RT Plan information object generated by AdvantageSim, and the requirements for RT Plan objects imported into AdvantageSim.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.

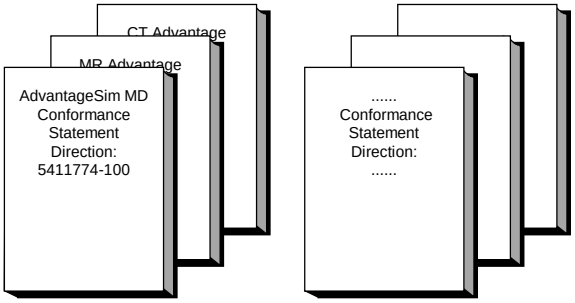
GEHC DICOM Conformance Statements

@

http://www.ge.com/DICOM

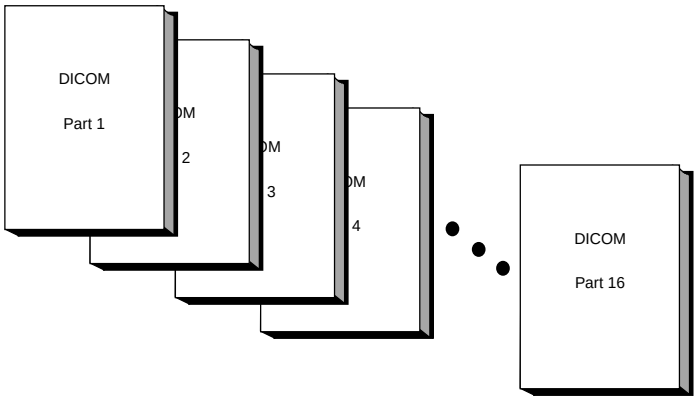
APPLICATION ENTITY SPECIFICATION
(SERVICE CLASSES, INFORMATION OBJECTS, MESSAGE EXCHANGES, ETC.)

Product Implementation:



DICOM STANDARD

Standard Specification:



This document specifies the DICOM implementation. It is entitled:

AdvantageSim MD 8

Conformance Statement for DICOM

Direction **5411774-100**

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required interoperating with the GEHC network interface.

The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat

NEMA

1300 N. 17th Street, Suite 1752

Rosslyn, VA 22209

USA

Phone: +1.703.841.3200

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility

to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failures to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 REFERENCES

NEMA PS3	Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/	
ADVANTAGE WORKSTATION 4.6	Conformance Statement for DICOM V3.0	5404296-100
AW SERVER GEN 2	DICOM Conformance Statement	5367884-100 Rev. 1

1.7 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 endpoint of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

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

Service/Object Pair (SOP) Instance – 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.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
CAD	Computer Aided Detection
CDA	Clinical Document Architecture
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
CR	Computed Radiography
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
DIT	Directory Information Tree (LDAP)
DN	Distinguished Name (LDAP)
DNS	Domain Name System
DX	Digital X-ray
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
IO	Intra-oral X-ray
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format

LUT	Look-up Table
MAR	Medication Administration Record
MPEG	Moving Picture Experts Group
MG	Mammography (X-ray)
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OP	Ophthalmic Photography
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
RIS	Radiology Information System
RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
US	Ultrasound
VL	Visible Light
VR	Value Representation
XA	X-ray Angiography

2 NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the AdvantageSim MD compliance to DICOM requirements for **Networking** features.

AdvantageSim is a radiotherapy virtual simulation application that is installed on Advantage Workstation or AW Server platform. These platforms use DICOM services to import acquisition images for possible further analysis or processing, and to export images and radiotherapy data to other vendors.

AdvantageSim MD does not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE. For some detailed information on DICOM features of Advantage Windows or AW Server platform, refer to the respective Conformance Statement of the platform where AdvantageSim MD application is running (See 1.6 References).

The application parses the following DICOM objects:

SOP Class Name	SOP Class UID
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5

The application creates the following DICOM objects:

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
RT Image Information Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5

2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

Refer to the respective Conformance Statement - Advantage Workstation and AW Server where AdvantageSim MD application is running (See 1.6 References).

2.2.2 Functional Definition of AE's

AdvantageSim MD is used to prepare geometric and anatomical data relating to a proposed external beam radiotherapy treatment prior to dosimetry planning. Anatomical volumes can be defined automatically or manually in three dimensions using a set of CT images acquired with the patient in the proposed treatment position.

The **goal of this document** is to give a detailed description of the:

- CT, MR and PET IMAGE DICOM IODs that are required to reconstruct the 3D volumes
- SC IMAGE and RT IMAGE IOD written by the application
- RT STRUCTURE SET and RT PLAN IOD written and read by the application.

2.2.3 Sequencing of Real-World Activities

Non Applicable

2.3 AE SPECIFICATIONS

2.3.1 AdvantageSim MD AE Specification

The AdvantageSim MD Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
RT Image Information Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes

2.3.1.1.1 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

AdvantageSim MD Implementation UID	**1.2.840.113619.6.196**
AdvantageSim MD Implementation Version Name	**ADVSIM70**

2.4 SUPPORT OF EXTENDED CHARACTER SETS

AdvantageSim MD accepts only DICOM input with ISO IR 100 as Specific Character Set (0008,0005) if Specific Character Set defined. Other inputs will be rejected with an error message. DICOM output will be generated with either ISO IR 100 as Specific Character Set (0008,0005) tag or without Specific character set.

2.5 CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.6 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3 CT INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM CT Image IOD to represent the information included in CT Images received by this implementation. Corresponding attributes are conveyed using the module construct.

3.2 ADVANTAGESIM MD MAPPING OF DICOM ENTITIES

The AdvantageSim MD maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 3-1 MAPPING OF DICOM ENTITIES TO ADVANTAGESIM MD ENTITIES

DICOM IE	AdvantageSim MD Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

3.3 IOD MODULE TABLE

The Computed Tomography Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes.

TABLE 3-2 CT IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	3.4.1.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	3.4.2.1
	Patient Study	Used	3.4.2.2
	Clinical Trial Study	Not used	N/A
Series	General Series	Used	3.4.3.1
	Clinical Trial Series	Not used	N/A
Frame of Reference	Frame of Reference	Used	3.4.4.1
Equipment	General Equipment	Used	3.4.5.1
Image	General Image	Used	3.4.6.1
	Image Plane	Used	3.4.6.2
	Image Pixel	Used	3.4.6.3
	Contrast/Bolus	Not used	N/A
	Device	Not used	N/A
	CT Image	Used	3.4.6.4
	Overlay Plane	Not used	N/A

Entity Name	Module Name	Usage	Reference
	VOI LUT	Not used	N/A
	SOP Common	Used	3.4.6.5

3.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the CT Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes Patient, Clinical Trial Subject, General Study, Patient Study, General Series, Frame of Reference, General Equipment, General Image, Image Plane, Image Pixel, CT Image and SOP Common.

Type 1 & Type 2 Attributes are also included for completeness and to define what the expected values when loading such instance are. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note the attributes that are not present in tables are not supported.

3.4.1 Patient Entity Modules

3.4.1.1 Patient Module

TABLE 3-3
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Non-empty patient name required.
Patient ID	(0010,0020)	2	Used for display if provided. **Strongly recommended for safe patient identification**.
Include Table 3-4 ISSUER OF PATIENT ID MACRO			Read
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Not used
>Include 'SOP Instance Reference Macro'			
Patient's Birth Time	(0010,0032)	3	Used
Other Patient IDs	(0010,1000)	3	Used
Other Patient IDs Sequence	(0010,1002)	3	Used
>Patient ID	(0010,0020)	1	Used
>Include Table 3-4 ISSUER OF PATIENT ID MACRO			Used
>Type of Patient ID	(0010,0022)	1	Used
Other Patient Names	(0010,1001)	3	Not used
Ethnic Group	(0010,2160)	3	Not used
Patient Comments	(0010,4000)	3	Not used
Patient Species Description	(0010,2201)	1C	Not used
Patient Species Code Sequence	(0010,2202)	1C	Not used
>Include 'Code Sequence Macro'			
Patient Breed Description	(0010,2292)	2C	Not used
Patient Breed Code Sequence	(0010,2293)	2C	Not used
>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
Breed Registration Sequence	(0010,2294)	2C	Not used
>Breed Registration Number	(0010,2295)	1	
>Breed Registry Code Sequence	(0010,2296)	1	
>>Include 'Code Sequence Macro'			
Responsible Person	(0010,2297)	2C	Not used
Responsible Person Role	(0010,2298)	1C	Not used
Responsible Organization	(0010,2299)	2C	Not used
Patient Identity Removed	(0012,0062)	3	Not used
De-identification Method	(0012,0063)	1C	Not used
De-identification Method Code Sequence	(0012,0064)	1C	Not used
>Include 'Code Sequence Macro'			

TABLE 3-4
ISSUER OF PATIENT ID MACRO

Attribute Name	Tag	Type	Attribute Description
Issuer of Patient ID	(0010,0021)	3	Used
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Used
> Universal Entity ID	(0040,0032)	3	Used
> Universal Entity ID Type	(0040,0033)	1C	Used
> Identifier Type Code	(0040,0035)	3	Used

3.4.2 Study Entity Modules

3.4.2.1 General Study Module

TABLE 3-5
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Used by AdvantageSim for RT object creation.
Study Date	(0008,0020)	2	Used for display if provided.
Study Time	(0008,0030)	2	Used for display if provided.
Referring Physician's Name	(0008,0090)	2	Used for display if provided.
Referring Physician Identification Sequence	(0008,0096)	3	Not used
>Include 'Person Identification Macro'			
Study ID	(0020,0010)	2	Required
Accession Number	(0008,0050)	2	Used if provided.
Study Description	(0008,1030)	3	Used if provided.
Physician(s) of Record	(0008,1048)	3	Not used

Attribute Name	Tag	Type	Attribute Description
Physician(s) of Record Identification Sequence	(0008,1049)	3	Not used
>Include 'Person Identification Macro'			
Name of Physician(s) Reading Study	(0008,1060)	3	Not used
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	Not used
>Include 'Person Identification Macro'			
Referenced Study Sequence	(0008,1110)	3	Not used
>Include 'SOP Instance Reference Macro'			
Procedure Code Sequence	(0008,1032)	3	Not used
>Include 'Code Sequence Macro'			

3.4.2.2 Patient Study Module

TABLE 3-6
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Not used.
Admitting Diagnoses Code Sequence	(0008,1084)	3	Not used.
>Include 'Code Sequence Macro'			
Patient's Age	(0010,1010)	3	Used
Patient's Size	(0010,1020)	3	Used
Patient's Weight	(0010,1030)	3	Used
Occupation	(0010,2180)	3	Not used
Additional Patient's History	(0010,21B0)	3	Used
Admission ID	(0038,0010)	3	Not used
Issuer of Admission ID	(0038,0011)	3	Not used
Service Episode ID	(0038,0060)	3	Not used
Issuer of Service Episode ID	(0038,0061)	3	Not used
Service Episode Description	(0038,0062)	3	Not used
Patient's Sex Neutered	(0010,2203)	2C	Not used

3.4.3 Series Entity Modules

3.4.3.1 General Series Module

TABLE 3-7
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used: CT, PT, MR.
Series Instance UID	(0020,000E)	1	Used by AdvantageSim for RT Structure Set creation.
Series Number	(0020,0011)	2	Used if provided
Laterality	(0020,0060)	2C	Not used

Attribute Name	Tag	Type	Attribute Description
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Performing Physicians' Name	(0008,1050)	3	Used
Performing Physician Identification Sequence	(0008,1052)	3	Not used
>Include 'Person Identification Macro'			
Protocol Name	(0018,1030)	3	Used
Series Description	(0008,103E)	3	Used by AdvantageSim for display purposes.
Operators' Name	(0008,1070)	3	Used
Operator Identification Sequence	(0008,1072)	3	Not used
>Include 'Person Identification Macro'			
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Not used
>Include 'SOP Instance Reference Macro'		Not used	
Related Series Sequence	(0008,1250)	3	Not used
>Study Instance UID	(0020,000D)	1	Not used
>Series Instance UID	(0020,000E)	1	Not used
>Purpose of Reference Code Sequence	(0040,A170)	2	Not used
>>Include 'Code Sequence Macro'		Not used	
Body Part Examined	(0018,0015)	3	Not used
Patient Position	(0018,5100)	2C	Used by AdvantageSim for patient model reconstruction. If absent, AdvantageSim defaults to "HFS" after user confirmation. The defined terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine GE strongly recommends that this attribute be systematically provided.
Smallest Pixel Value in Series	(0028,0108)	3	Not used.
Largest Pixel Value in Series	(0028,0109)	3	Not used.
Request Attributes Sequence	(0040,0275)	3	Not used.
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>> Include 'SOP Instance Reference Macro'			
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	

Attribute Name	Tag	Type	Attribute Description
>>Include 'Code Sequence Macro'			
Reason for the Requested Procedure	(0040,1002)	3	Not used
Reason for Requested Procedure Code Sequence	(0040,100A)	3	Not used
>>Include' Code Sequence Macro'			
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Include 'Code Sequence Macro'			
>>Protocol Context Sequence	(0040,0440)	3	
>>>Include 'Content Item Macro'			
>>>Content Item Modifier Sequence	(0040,0441)	3	
>> >>Include 'Content Item Macro'			
Performed Procedure Step ID	(0040,0253)	3	Not used
Performed Procedure Step Start Date	(0040,0244)	3	Not used
Performed Procedure Step Start Time	(0040,0245)	3	Not used
Performed Procedure Step Description	(0040,0254)	3	Not used
Performed Protocol Code Sequence	(0040,0260)	3	Not used
>Include 'Code Sequence Macro'			
>>Protocol Context Sequence	(0040,0440)	3	
>>>Include 'Content Item Macro'			
>>>Content Item Modifier Sequence	(0040,0441)	3	
>> >>Include 'Content Item Macro'			
Comments on the Performed Procedure Step	(0040,0280)	3	Not used

3.4.4 Frame Of Reference Entity Modules

3.4.4.1 Frame Of Reference Module

TABLE 3-8
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Used. AdvantageSim to identify registered series. Not used to identify registered images if image is from Advantage Fusion software
Position Reference Indicator	(0020,1040)	2	Not used.

3.4.4.1.1 Frame Of Reference UID

The Frame of Reference UID is used to spatially relate a set of axial images. All images having the same Frame Of Reference UID are handled as acquired in the same patient setup for scan.

3.4.5 Equipment Entity Modules

3.4.5.1 General Equipment Module

TABLE 3-9
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used
Institution Name	(0008,0080)	3	Used for display
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Used
Institutional Department Name	(0008,1040)	3	Not used.
Manufacturer's Model Name	(0008,1090)	3	Used
Device Serial Number	(0018,1000)	3	Not used.
Software Versions	(0018,1020)	3	Used.
Gantry ID	(0018,1008)	3	Not used.
Spatial Resolution	(0018,1050)	3	Not used.
Date of Last Calibration	(0018,1200)	3	Not used.
Time of Last Calibration	(0018,1201)	3	Not used.
Pixel Padding Value	(0028,0120)	1C	Used

3.4.6 Image Entity Modules

3.4.6.1 General Image Module

TABLE 3-10
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used if provided
Patient Orientation	(0020,0020)	2C	Not used, instead Image Orientation and Image Position is used
Content Date	(0008,0023)	2C	Used by AdvantageSim if provided (image time stamp).
Content Time	(0008,0033)	2C	Used by AdvantageSim if provided (image time stamp).
Image Type	(0008,0008)	3	Used
Acquisition Number	(0020,0012)	3	Used
Acquisition Date	(0008,0022)	3	Used
Acquisition Time	(0008,0032)	3	Used
Acquisition DateTime	(0008,002A))	3	Not used
Referenced Image Sequence	(0008,1140)	3	Not used
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
Derivation Description	(0008,2111)	3	Not used.
Derivation Code Sequence	(0008,9215)	3	Not used.

Attribute Name	Tag	Type	Attribute Description
>Include 'Code Sequence Macro'			
Source Image Sequence	(0008,2112)	3	Not used.
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
>Spatial Locations Preserved	(0028,135A)	3	
>Patient Orientation	(0020,0020)	1C	
Referenced Instance Sequence	(0008,114A)	3	Not used
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			
Images in Acquisition	(0020,1002)	3	Not used
Image Comments	(0020,4000)	3	Not used
Quality Control Image	(0028,0300)	3	Not used
Burned In Annotation	(0028,0301)	3	Used
Lossy Image Compression	(0028,2110)	3	Used
Lossy Image Compression Ratio	(0028,2112)	3	Not used
Lossy Image Compression Method	(0028,2114)	3	Not used
Icon Image Sequence	(0088,0200)	3	Not used
>Include 'Image Pixel Macro'		Not used	
Presentation LUT Shape	(2050,0020)	3	Not used

3.4.6.2 Image Plane Module

TABLE 3-11
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Used for patient model reconstruction. PIXELS MUST BE SQUARE (i.e. X and Y values must be equal).
Image Orientation (Patient)	(0020,0037)	1	Used for patient model reconstruction. IMAGES MUST NOT HAVE GANTRY TILT OR SWIVEL (i.e. only one of each (x,y,z) cosine triplet can be non-zero).
Image Position (Patient)	(0020,0032)	1	Used for patient model reconstruction.
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Used

3.4.6.3 Image Pixel Module

TABLE 3-12
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	For CT modality see Table 3-13 CT IMAGE

Attribute Name	Tag	Type	Attribute Description
			MODULE ATTRIBUTES For MR modality see Table 4-18 MR IMAGE MODULE ATTRIBUTES For PET modality see Table 5-24 PET IMAGE MODULE ATTRIBUTES
Photometric Interpretation	(0028,0004)	1	For CT modality see Table 3-13 CT IMAGE MODULE ATTRIBUTES For MR modality see Table 4-18 MR IMAGE MODULE ATTRIBUTES For PET modality see Table 5-24 PET IMAGE MODULE ATTRIBUTES
Rows	(0028,0010)	1	Used for patient model reconstruction. ROWS AND COLUMNS MUST BE EQUAL.
Columns	(0028,0011)	1	Used for patient model reconstruction. ROWS AND COLUMNS MUST BE EQUAL.
Bits Allocated	(0028,0100)	1	For CT modality see Table 3-13 CT IMAGE MODULE ATTRIBUTES For MR modality see Table 4-18 MR IMAGE MODULE ATTRIBUTES For PET modality see Table 5-24 PET IMAGE MODULE ATTRIBUTES
Bits Stored	(0028,0101)	1	For CT modality see Table 3-13 CT IMAGE MODULE ATTRIBUTES For MR modality see Table 4-18 MR IMAGE MODULE ATTRIBUTES For PET modality see Table 5-24 PET IMAGE MODULE ATTRIBUTES
High Bit	(0028,0102)	1	For CT modality see Table 3-13 CT IMAGE MODULE ATTRIBUTES For MR modality see Table 4-18 MR IMAGE MODULE ATTRIBUTES For PET modality see Table 5-24 PET IMAGE MODULE ATTRIBUTES
Pixel Representation	(0028,0103)	1	Not used, shall be “1”.
Pixel Data	(7FE0,0010)	1	Used for patient model reconstruction.
Planar Configuration	(0028,0006)	1C	Not used.
Pixel Aspect Ratio	(0028,0034)	1C	Not used.
Smallest Image Pixel Value	(0028,0106)	3	Not used.
Largest Image Pixel Value	(0028,0107)	3	Not used.
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used.
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used.

Attribute Name	Tag	Type	Attribute Description
ICC Profile	(0028,2000)	3	Not used.
Pixel Data Provider URL	(0028,7FE0)	1C	Not used.
Pixel Padding Range Limit	(0028,0121)	1C	Not used.

3.4.6.4 CT Image Module

TABLE 3-13
CT IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used for image type identification. See 3.4.6.4.1
Samples per Pixel	(0028,0002)	1	Not used. Shall be 1.
Photometric Interpretation	(0028,0004)	1	Not used. Shall be "MONOCHROME2".
Bits Allocated	(0028,0100)	1	Shall be 16.
Bits Stored	(0028,0101)	1	Mandatory (expect 16)
High Bit	(0028,0102)	1	Ignored (expect 15)
Rescale Intercept	(0028, 1052)	1	Used for patient model reconstruction.
Rescale Slope	(0028,1053)	1	Used for patient model reconstruction.
KVP	(0018,0060)	2	Used
Acquisition Number	(0020,0012)	2	Not used.
Scan Options	(0018,0022)	3	Used. 'CINE MODE' used to check 4D scan.
Data Collection Diameter	(0018,0090)	3	Used
Data Collection Center (Patient)	(0018,0090)	3	Not used
Reconstruction Diameter	(0018,1100)	3	Not used
Reconstruction Target Center (Patient)	(0018,9318)	3	Not used
Distance Source to Detector	(0018,1110)	3	Not used
Distance Source to Patient	(0018,1111)	3	Not used
Gantry/Detector Tilt	(0018,1120)	3	Used. AdvantageSim rejects images with Gantry Tilt - see Image Orientation (Patient) attribute.
Table Height	(0018,1130)	3	Not used
Rotation Direction	(0018,1140)	3	Not used
Exposure Time	(0018,1150)	3	Used
X-ray Tube Current	(0018,1151)	3	Used
Exposure	(0018,1152)	3	Not used
Exposure in µAs	(0018,1153)	3	Not used
Filter Type	(0018,1160)	3	Not used
Generator Power	(0018,1170)	3	Not used
Focal Spot	(0018,1190)	3	Not used
Convolution Kernel	(0018,1210)	3	Used
Revolution Time	(0018,9305)	3	Not used
Single Collimation Width	(0018,9306)	3	Not used
Total Collimation Width	(0018,9307)	3	Not used

Attribute Name	Tag	Type	Attribute Description
Table Speed	(0018,9309)	3	Not used
Table Feed per Rotation	(0018,9310)	3	Not used
Spiral Pitch Factor	(0018,9311)	3	Not used
Exposure Modulation Type	(0018,9323)	3	Not used
Estimated Dose Saving	(0018,9324)	3	Not used
CTDIvol	(0018,9345)	3	Not used
CTDI Phantom Type Code Sequence	(0018,9346)	3	Not used
>Include Code Sequence Macro			
Anatomic Region Sequence	(0008,2218)	3	Not used
> Include 'Code Sequence Macro'			
> Anatomic Region Modifier Sequence	(0008,2220)	3	Not used
>> Include 'Code Sequence Macro'			
Primary Anatomic Structure Sequence	(0008,2228)	3	Not used
> Include 'Code Sequence Macro'			
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not used
>> Include 'Code Sequence Macro'			
Calcium Scoring Mass Factor Patient	(0018,9351)	3	Not used
Calcium Scoring Mass Factor Device	(0018,9352)	3	Not used
CT Additional X-Ray Source Sequence	(0018,9360)	3	Not used
>kVP	(0018,0060)	1	
>X-Ray Tube Current in mA	(0018,9330)	1	
>Data Collection Diameter	(0018,0090)	1	
>Focal Spot(s)	(0018,9190)	1	
>Filter Type(s)	(0018,9160)	1	
>Filter Material	(0018,7050)	1	

3.4.6.4.1 Image Type

The following values of Image Type (0008, 0008) are supported.

The following Enumerated Values of Value 1 are supported:

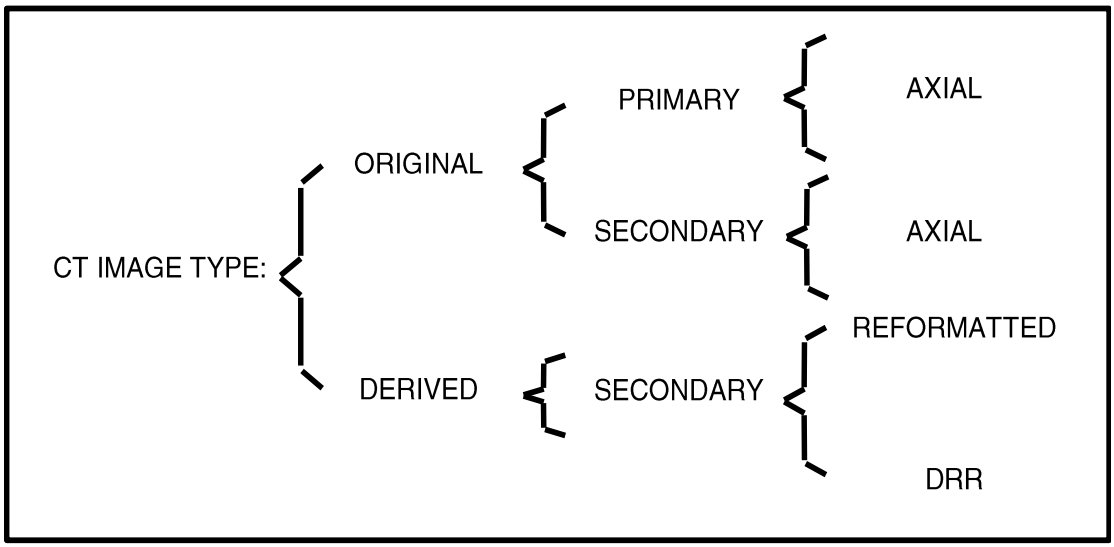
- ORIGINAL identifies an Original Image
- DERIVED identifies a Derived Image

The following Enumerated Values of Value 2 are supported:

- PRIMARY identifies a Primary Image
- SECONDARY identifies a Secondary Image

Any Defined Term of Value 3 is supported. The "DRR" value is written in case of an RT Image

ILLUSTRATION 3.4 -1
CT IMAGE TYPE DECISION TREE



3.4.6.5 SOP Common Module

TABLE 3-14
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used by AdvantageSim to confirm image class.
SOP Instance UID	(0008,0018)	1	Used by AdvantageSim for image identification.
Specific Character Set	(0008,0005)	1C	Supported Defined Terms: ISO_IR 100 = Latin Alphabet No. 1
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used
Related General SOP Class UID	(0008,001A)	3	
Original Specialized SOP Class UID	(0008,001B)	3	
Coding Scheme Identification Sequence	(0008,0110)	3	Not used
>Coding Scheme Designator	(0008,0102)	1	
>Coding Scheme Registry	(0008,0112)	1C	
>Coding Scheme UID	(0008,010C)	1C	
>Coding Scheme External ID	(0008,0114)	2C	
>Coding Scheme Name	(0008,0115)	3	
>Coding Scheme Version	(0008,0103)	3	
>Coding Scheme Responsible Organization	(0008,0116)	3	
Timezone Offset From UTC	(0008,0201)	3	Not used
Contributing Equipment Sequence	(0018,A001)	3	Not used

Attribute Name	Tag	Type	Attribute Description
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	1	
>Institution Name	(0008,0080)	3	
>Institution Address	(0008,0081)	3	
>Station Name	(0008,1010)	3	
>Institutional Department Name	(0008,1040)	3	
>Manufacturer's Model Name	(0008,1090)	3	
>Device Serial Number	(0018,1000)	3	
>Software Versions	(0018,1020)	3	
>Spatial Resolution	(0018,1050)	3	
>Date of Last Calibration	(0018,1200)	3	
>Time of Last Calibration	(0018,1201)	3	
>Contribution DateTime	(0018,A002)	3	
>Contribution Description	(0018,A003)	3	
Instance Number	(0020,0013)	3	See CT General Image Module
SOP Instance Status	(0100,0410)	3	Not used
SOP Authorization Date and Time	(0100,0420)	3	Not used
SOP Authorization Comment	(0100,0424)	3	Not used
Authorization Equipment Certification Number	(0100,0426)	3	Not used
MAC Parameters Sequence	(4FFE,0001)	3	Not used
>MAC ID Number	(0400,0005)	1	
>MAC Calculation Transfer Syntax UID	(0400,0010)	1	
>MAC Algorithm	(0400,0015)	1	
>Data Elements Signed	(0400,0020)	1	
Digital Signatures Sequence	(FFFA,FFFA)	3	Not used
>MAC ID Number	(0400,0005)	1	
>Digital Signature UID	(0400,0100)	1	
>Digital Signature DateTime	(0400,0105)	1	
>Certificate Type	(0400,0110)	1	
>Certificate of Signer	(0400,0115)	1	
>Signature	(0400,0120)	1	
>Certified Timestamp Type	(0400,0305)	1C	
>Certified Timestamp	(0400,0310)	3	
>Digital Signature Purpose Code Sequence	(0400,0401)	3	
>>Include 'Code Sequence Macro'			
Encrypted Attributes Sequence	(0400,0500)	1C	Not used
>Encrypted Content Transfer	(0400,0510)	1	

Attribute Name	Tag	Type	Attribute Description
Syntax UID			
>Encrypted Content	(0400,0520)	1	
Original Attributes Sequence	(0400,0561)	3	
>Source of Previous Values	(0400,0564)	2	
>Attribute Modification DateTime	(0400,0562)	1	
>Modifying System	(0400,0563)	1	
>Reason for the Attribute Modification	(0400,0565)	1	
>Modified Attributes Sequence	(0400,0550)	1	
>>Any Attribute from the main data set that was modified or removed; may include Sequence Attributes and their Items.			
HL7 Structured Document Reference Sequence	(0040,A390)	1C	Not used
>Referenced SOP Class UID	(0008,1150)	1	
>Referenced SOP Instance UID	(0008,1155)	1	
>HL7 Instance Identifier	(0040,E001)	1	
>Retrieve URI	(0040,E010)	3	

3.5 PRIVATE DATA

The following private elements are used.

TABLE 3.5-15
PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	VR	VM	Type	Attribute Description
Private Creator	(0019, 00xx)	LO	1	3	GEMS_ACQU_01: Used
Table Speed	(0019, xx23)	DS	1	3	Used
Midscan Time	(0019, xx24)	DS	1	3	Used
Gantry Velocity	(0019, xx27)	DS	1	3	Used
SFOV Type	(0019, xx39)	SS	1	3	Used
Dependent on #views processed	(0019, xx6A)	SS	1	3	Used
Private Creator	(0031, 00xx)	LO	1	3	GEMS_3D_XA_01: Used
Structure of Interest	(0031, xx01)	CS	1	3	Used
Missing Frame Status	(0031, xx02)	CS	1	3	Used
Anatomy	(0031, xx03)	CS	1	3	Used
Volume Substracted Mode	(0031, xx04)	CS	1	3	Used
Modality	(0031, xx07)	CS	1	3	Used
Pos Calibration Date	(0031, xx09)	DA	1	3	Used
Pos Calibration Status	(0031, xx0B)	CS	1	3	Used
Spin Phase of Volume	(0031,xx20)	CS	1	3	Used
Private Creator	(0043, 00xx)	LO	1	3	GEMS_PARM_01: Used
Pitch Ratio	(0043, xx27)	SH	1	3	Used
Private Scan Options	(0043, xx2B)	SS	1	3	Used
motCorr	(0043, xx65)	US	1	3	Used
IBOCorr	(0043, xx67)	US	1	3	Used
Private Creator	(0045, 00xx)	LO	1	3	GEMS_HELIOS_01: Used
Sigma Mode	(0045, xx13)	SS	1	3	Ignored
Ibone Flag	(0045, xx21)	SS	1	3	Used
Peris Flag	(0045, xx22)	SS	1	3	Used
Cardiac Recon Algo	(0045, xx30)	CS	1	3	Used
Average Heart Rate	(0045, xx31)	CS	1	3	Used
Temporal Resolution	(0045, xx32)	FL	1	3	Used
Cardiac Phase Number	(0045, xx33)	CS	1	3	Used
Noise Reduction Image Filter Description	(0045, xx33)	LO	1	3	Used
Actual Rpeak Fixed Time Delay	(0045, xx3F)	CS	1	3	Used
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used
Private User Data	(0047, xx11)	LT	1	3	Used to detect Advantage Fusion images
Private creator	(0051,00xx)	LO	1	3	“GEMS_FUNCTOOL_01”
Group name	(0051,xx01)	LO	1	3	Used
Function name	(0051,xx02)	LO	1	3	Used
Bias	(0051,xx03)	SL	1	3	Used

Attribute Name	Tag	VR	VM	Type	Attribute Description
Scale	(0051,xx04)	FL	1	3	Used
Parameter count	(0051,xx05)	SL	1	3	Used
Parameters	(0051,xx06)	LT	1	3	Used
Version	(0051,xx07)	LO	1	3	Used
Color ramp index	(0051,xx08)	SL	1	3	Used
Window width	(0051,xx09)	SL	1	3	Used
Window level	(0051,xx0A)	SL	1	3	Used
BValue	(0051,xx0B)	SL	1	3	Ignored
Wizard state data size	(0051,xx0C)	SL	1	3	Ignored
Wizard State	(0051,xx0D)	OB	1	3	Ignored
Hidden	(0051,xx0E)	SL	1	3	Used
Private Creator	(0053,00xx)	LO	1	3	GEHC_CT_ADVAPP_001: Used
Type of Shuttle Acquisition	(0053,xx20)	IS	1	3	Used
ASIR Information	(0053,xx40)	SH	1	3	Used
High Resolution Mode	(0053,xx61)	SH	1	3	Used
Image Position Patient Setting	(0053,xx63)	CS	1	3	Used
Multi Energy Image Type	(0053,xx73)	LO	1	3	Used
Monochromatic Energy	(0053,xx75)	DS	1	3	Used
Sub Optimal IQ String	(0053,xx7D)	LO	1	3	Used
Annotation mA	(0053,xx83)	DS	1	3	Used
Multi Energy KV Annot Name	(0053,xx88)	SH	1	3	Used
Multi Energy KV Unit Label	(0053,xx89)	SH	1	3	Used
Material Type #1	(0053,xx8A)	LO	1	3	Used
Material Type #2	(0053,xx8B)	LO	1	3	Used
GSI Scan Mode Preset	(0053,xx8C)	LO	1	3	Used
MARs Annotation	(0053,xx9D)	LO	1	3	Used
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used
Deformed Flag	(0059, xx00)	IS	1	3	Used

4 MR INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

This section specifies the use of the DICOM MR Image IOD to represent the information included in MR Images received by this implementation. Corresponding attributes are conveyed using the module construct.

4.2 ADVANTAGESIM MD MAPPING OF DICOM ENTITIES

The AdvantageSim MD maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 4-16
MAPPING OF DICOM ENTITIES TO ADVANTAGESIM MD ENTITIES

DICOM IE	AdvantageSim MD Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

4.3 IOD MODULE TABLE

Within an entity of the DICOM MR Image Information Object Definition, attributes are grouped into a related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

The Magnetic Resonance Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes.

TABLE 4-17
MR IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 3.4.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 3.4.2.1
	Patient Study	Used	See 3.4.2.2
	Clinical Trial Study	Not used	N/A
Series	General Series	Used	See 3.4.3.1
	Clinical Trial Series	Not used	N/A
Frame of Reference	Frame of Reference	Used	See 3.4.4
Equipment	General Equipment	Used	See 3.4.5.1
Image	General Image	Used	See 3.4.6.1
	Image Plane	Used	See 3.4.6.2

Entity Name	Module Name	Usage	Reference
	Image Pixel	Used	See 3.4.6.3
	Contrast/Bolus	Not used	N/A
	Device	Not used	N/A
	MR Image	Used	See 4.4.1.1
	Overlay Plane	Not used	N/A
	VOI LUT	Not used	N/A
	SOP Common	Used	See 3.4.6.5

4.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the CT Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported and/or expected. Type 1 & Type 2 Attributes are also included for completeness and to define what the expected values when loading such instance are. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that the attributes that are not present in tables are not supported.

4.4.1 Image Entity Modules

4.4.1.1 MR Image Module

TABLE 4-18
MR IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used for image type identification. See 4.4.1.1.1
Samples per Pixel	(0028,0002)	1	Not used. Shall be 1.
Photometric Interpretation	(0028,0004)	1	Not used. Shall be “MONOCHROME2”.
Bits Allocated	(0028,0100)	1	Shall be 16.
Scanning Sequence	(0018,0020)	1	Used.
Sequence Variant	(0018,0021)	1	Used.
Scan Options	(0018,0022)	2	Used.
MR Acquisition Type	(0018,0023)	2	Used.
Repetition Time	(0018,0080)	2C	Used.
Echo Time	(0018,0081)	2	Used
Echo Train Length	(0018,0091)	2	Used
Inversion Time	(0018,0082)	2C	Used.
Trigger Time	(0018,1060)	2C	Used.
Sequence Name	(0018,0024)	3	Not used.
Angio Flag	(0018,0025)	3	Not used.
Number of Averages	(0018,0083)	3	Used
Imaging Frequency	(0018,0084)	3	Used
Imaged Nucleus	(0018,0085)	3	Not used.

Attribute Name	Tag	Type	Attribute Description
Echo Number	(0018,0086)	3	Used
Magnetic Field Strength	(0018,0087)	3	Used
Spacing Between Slices	(0018,0088)	3	Not used.
Number of Phase Encoding Steps	(0018,0089)	3	Not used.
Percent Sampling	(0018,0093)	3	Used
Percent Phase Field of View	(0018,0094)	3	Not used.
Pixel Bandwidth	(0018,0095)	3	Used
Nominal Interval	(0018,1062)	3	Not used.
Beat Rejection Flag	(0018,1080)	3	Not used.
Low R-R Value	(0018,1081)	3	Not used.
High R-R Value	(0018,1082)	3	Not used.
Intervals Acquired	(0018,1083)	3	Not used.
Intervals Rejected	(0018,1084)	3	Not used.
PVC Rejection	(0018,1085)	3	Not used.
Skip Beats	(0018,1086)	3	Not used.
Heart Rate	(0018,1088)	3	Not used.
Cardiac Number of Images	(0018,1090)	3	Used
Trigger Window	(0018,1094)	3	Not used.
Reconstruction Diameter	(0018,1100)	3	Not used.
Receive Coil Name	(0018,1250)	3	Used
Transmit Coil Name	(0018,1251)	3	Not used
Acquisition Matrix	(0018,1310)	3	Used
Phase Encoding Direction	(0018,1312)	3	Not used
Flip Angle	(0018,1314)	3	Used
SAR	(0018,1316)	3	Not used
Variable Flip Angle Flag	(0018,1315)	3	Not used
dB/dt	(0018,1318)	3	Not used
Temporal Position Identifier	(0020,0100)	3	Used
Number of Temporal Positions	(0020,0105)	3	Used
Temporal Resolution	(0020,0110)	3	Not used
Stack ID	(0020,9056)	3	Used
Anatomic Region Sequence	(0008,2218)	3	Not used
> Include ‘Code Sequence Macro’			
> Anatomic Region Modifier Sequence	(0008,2220)	3	
>> Include ‘Code Sequence Macro’			
Primary Anatomic Structure Sequence	(0008,2228)	3	Not used
> Include ‘Code Sequence Macro’			
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	
>> Include ‘Code Sequence Macro’			

4.4.1.1.1 Image Type

The following values of Image Type (0008,0008) are supported.

The Enumerated Values of Value 1 are supported:

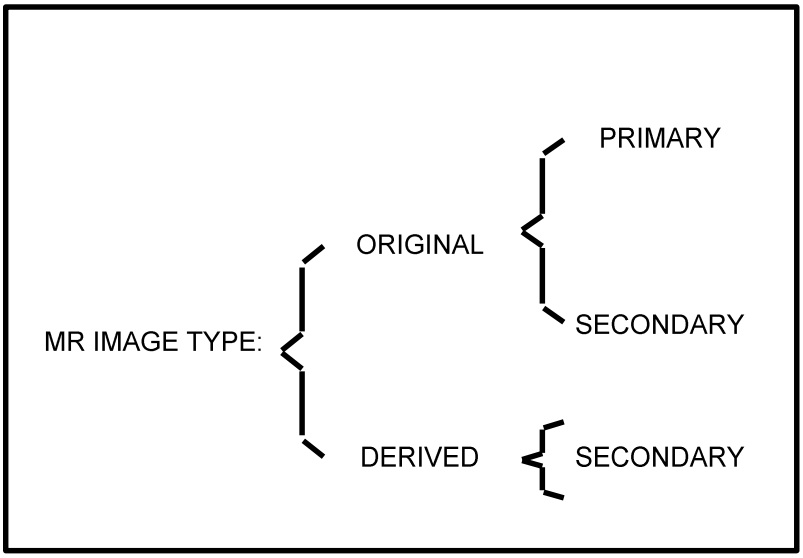
- ORIGINAL identifies an Original Image
- DERIVED identifies a Derived Image

The Enumerated Values of Value 2 are supported:

- PRIMARY identifies a Primary Image
- SECONDARY identifies a Secondary Image

Any standard Defined Terms of Value 3 is supported.

ILLUSTRATION 4.4 -1
MR IMAGE TYPE DECISION TREE



4.5 PRIVATE DATA DICTIONARY

TABLE 4.5-19
PRIVATE ATTRIBUTES

Attribute Name	Tag	VR	VM	Type	Attribute Description
Private Creator	(0009, 00xx)	LO	1	3	GEMS_IDEN_01: Used
Genesis Full Fidelity Flag	(0009, xx01)	LO	1	3	Used
Suite ID	(0009, xx02)	SH	1	3	Ignored
Product ID	(0009, xx04)	SH	1	3	Used
Series Type	(0009,xx1A)	US	1	3	Used
Unique Service ID	(0009, xx30)	SH	1	3	Ignored
Mobile Location Number	(0009, xx31)	SH	1	3	Ignored
Equipment UID	(0009, xxE3)	UI	1	3	Ignored
Genesis Version – Now	(0009, xxE6)	SH	1	3	Ignored
Private Creator	(0019, 00xx)	LO	1	3	GEMS_ACQU_01: Used
Series Pulse Sequence	(0019, xx12)	SS	1	3	Ignored

Attribute Name	Tag	VR	VM	Type	Attribute Description
Display FOV-Y	(0019, xx1E)	DS	1	3	Ignored
Duration of scan	(0019, xx5A)	FL	1	3	Used
Number of echos	(0019, xx7E)	SS	1	3	Used
Continuous slices flag	(0019, xx81)	SS	1	3	Ignored
actual receive gain analog	(0019, xx8A)	SS	1	3	Ignored
actual receive gain digital	(0019, xx8B)	SS	1	3	Ignored
Swap Phase/Freq. Axis	(0019, xx8F)	SS	1	3	Used
Pause Time	(0019, xx91)	DS	1	3	Ignored
Pulse Sequence Name	(0019, xx9C)	LO	1	3	Used
Coil Type	(0019, xx9F)	SS	1	3	Ignored
SAT fat/water/bone	(0019, xxA4)	SS	1	3	Used
User Variable0	(0019, xxA7)	SS	1	3	Ignored
User Variable1	(0019, xxA8)	DS	1	3	Ignored
User Variable2	(0019, xxA9)	DS	1	3	Ignored
User Variable3	(0019, xxAA)	DS	1	3	Ignored
User Variable4	(0019, xxAB)	DS	1	3	Ignored
User Variable5	(0019, xxAC)	DS	1	3	Ignored
User Variable6	(0019, xxAD)	DS	1	3	Ignored
User Variable7	(0019, xxAE)	DS	1	3	Ignored
User Variable8	(0019, xxAF)	DS	1	3	Used
User Variable9	(0019, xxB0)	DS	1	3	Used
User Variable10	(0019, xxB1)	DS	1	3	Used
User Variable11	(0019, xxB2)	DS	1	3	Used
User Variable12	(0019, xxB3)	DS	1	3	Used
User Variable13	(0019, xxB4)	DS	1	3	Used
User Variable14	(0019, xxB5)	DS	1	3	Ignored
User Variable15	(0019, xxB6)	DS	1	3	Ignored
User Variable16	(0019, xxB7)	DS	1	3	Ignored
User Variable17	(0019, xxB8)	DS	1	3	Ignored
User Variable18	(0019, xxB9)	DS	1	3	Ignored
User Variable19	(0019, xxBA)	DS	1	3	Ignored
User Variable20	(0019, xxBB)	DS	1	3	Ignored
User Variable21	(0019, xxBC)	DS	1	3	Ignored
User Variable22	(0019, xxBD)	DS	1	3	Ignored
Saturation Planes	(0019, xxC0)	SS	1	3	Used
Surface Coil Intensity Correction Flag	(0019, xxC1)	SS	1	3	Used
Phase contrast flow axis	(0019, xxCB)	SS	1	3	Used
Velocity Encoding	(0019, xxCC)	SS	1	3	Used
Fractional Echo/EffectiveTE	(0019, xxD5)	SS	1	3	Used
Cardiac Phase Number	(0019, xxD7)	SS	1	3	Used
variable echo flag	(0019, xxD8)	SS	1	3	Used

Attribute Name	Tag	VR	VM	Type	Attribute Description
Concatenated Sat Type flg	(0019, xxD9)	DS	1	3	Used
User Variable23	(0019, xxDF)	DS	1	3	Ignored
User Variable24	(0019, xxE0)	DS	1	3	Ignored
Number of Phases	(0019, xxF2)	SS	1	3	Used
Transmit Gain	(0019, xxF9)	DS	1	3	Ignored
Private Creator	(0021, 00xx)	LO	1	3	GEMS_RELA_01: Used
Series from which prescribed	(0021, xx03)	SS	1	3	Ignored
Genesis Version	(0021, xx05)	SH	1	3	Ignored
Series from which prescribed	(0021, xx35)	SS	1	3	Ignored
Image from which prescribed	(0021, xx36)	SS	1	3	Ignored
Screen Format	(0021, xx37)	SS	1	3	Ignored
Row Axis Rot from src img	(0021, xx51)	DS	1	3	Ignored
Col Axis Rot from src img	(0021, xx52)	DS	1	3	Ignored
Normal Axis Rot from src img	(0021, xx53)	DS	1	3	Ignored
Slop int 1	(0021, xx56)	SL	1	3	Ignored
Slop int 2	(0021, xx57)	SL	1	3	Ignored
Slop int 3	(0021, xx58)	SL	1	3	Ignored
Slop int 4	(0021, xx59)	SL	1	3	Ignored
Slop int 5	(0021, xx5A)	SL	1	3	Ignored
Slop float 1	(0021, xx5B)	DS	1	3	Ignored
Slop float 2	(0021, xx5C)	DS	1	3	Ignored
Slop float 3	(0021, xx5D)	DS	1	3	Ignored
Slop float 4	(0021, xx5E)	DS	1	3	Ignored
Slop float 5	(0021, xx5F)	DS	1	3	Ignored
Private Creator	(0025, 00xx)	LO	1	3	GEMS_SERS_01: Used
Primary Receiver	(0025, xx1A)	SH	1	3	Ignored
Private Creator	(0027, 00xx)	LO	1	3	GEMS_IMAG_01: Used
Imaging Mode	(0027, xx31)	SS	1	3	Ignored
Pulse Sequence	(0027, xx32)	SS	1	3	Used
Imaging Options	(0027, xx33)	SL	1	3	Ignored
Plane Type	(0027, xx35)	SS	1	3	Ignored
RAS letter of image loc	(0027, xx40)	SH	1	3	Ignored
Image Location	(0027, xx41)	FL	1	3	Ignored
Image Dimension – X	(0027, xx60)	FL	1	3	Ignored
Image Dimension – Y	(0027, xx61)	FL	1	3	Ignored
Number of Excitations	(0027, xx62)	FL	1	3	Ignored
Private Creator	(0029, 00xx)	LO	1	3	GEMS_IMPS_01: Used
Version of the hdr structure	(0029, xx26)	SS	1	3	Ignored
Lower Range of Pixels 1	(0029, xx15)	SL	1	3	Ignored
Upper Range of Pixels 1	(0029, xx16)	SL	1	3	Ignored
Private Creator	(0043, 00xx)	LO	1	3	GEMS_PARM_01: Used

Attribute Name	Tag	VR	VM	Type	Attribute Description
Bitmap of prescan options	(0043, xx01)	SS	1	3	Ignored
Number of EPI shots	(0043, xx06)	SS	1	3	Ignored
Views per segment	(0043, xx07)	SS	1	3	Ignored
Respiratory rate	(0043, xx08)	SS	1	3	Ignored
Respiratory trigger point	(0043, xx09)	SS	1	3	Ignored
Type of receiver used	(0043, xx0A)	SS	1	3	Ignored
Peak rate of change of Gradient field	(0043, xx0B)	DS	1	3	Ignored
Limit in units per percent	(0043, xx0C)	DS	1	3	Ignored
Version of header structure	(0043, xx26)	US	6	3	Ignored
Filter Mode	(0043, xx2D)	LO	1	3	Used
Image Type	(0043, xx2F)	SS	1	3	Used
Collapse Image	(0043, xx30)	SS	1	3	Ignored
User usage tag	(0043, xx35)	UL	1	3	Ignored
User Variable25…User Variable48	(0043, xx38)	FL	24	3	Ignored
Slop Int 6 ... 9	(0043, xx39)	IS	4	3	Ignored
Slop Int 10 ... 17	(0043, xx60)	IS	8	3	Ignored
Scanner Study Entity UID	(0043, xx61)	UI	1	3	Ignored
Scanner Study UID	(0043, xx62)	SH	1	3	Ignored
Table Position / angle / offset / WholeOrZoom	(0043, xx6F)	DS	3-4	3	Ignored
eDWI Scale Factor	(0043,xx7F)	DS	1	3	Used
Additional Asset Data	(0043, xx84)	LO	7	3	Used
Spectro Parameters	(0043, xx8F)	DS		3	Used
Image filtering parameters	(0043, xx97)	LO	9	3	Ignored
Number of Stacks	(0043,xx9A)	IS	1	3	Used
ASL Contrast Technique	(0043, xxA3)	CS	1	3	Used
Detailed Text Describing Used Labeling Technique	(0043, xxA4)	LO	1	3	Used
Duration of the Label or Control Pulse	(0043, xxA5)	IS	1	3	Used
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used
Private User Data	(0047, xx11)	LT	1	3	Used
Private creator	(0051,00xx)	LO	1	3	“GEMS_FUNCTOOL_01”
Group name	(0051,xx01)	LO	1	3	Used
Function name	(0051,xx02)	LO	1	3	Used
Bias	(0051,xx03)	SL	1	3	Used
Scale	(0051,xx04)	FL	1	3	Used
Parameter count	(0051,xx05)	SL	1	3	Used
Parameters	(0051,xx06)	LT	1	3	Used
Version	(0051,xx07)	LO	1	3	Used
Color ramp index	(0051,xx08)	SL	1	3	Used
Window width	(0051,xx09)	SL	1	3	Used

Attribute Name	Tag	VR	VM	Type	Attribute Description
Window level	(0051,xx0A)	SL	1	3	Used
BValue	(0051,xx0B)	SL	1	3	Ignored
Wizard state data size	(0051,xx0C)	SL	1	3	Ignored
Wizard State	(0051,xx0D)	OB	1	3	Ignored
Hidden	(0051,xx0E)	SL	1	3	Used
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used
Deformed Flag	(0059, xx00)	IS	1	3	Used

5 PET INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

This section specifies the use of the DICOM PET Image IOD to represent the information included in PET Images received by this implementation. Corresponding attributes are conveyed using the module construct.

5.2 ADVANTAGESIM MD MAPPING OF DICOM ENTITIES

The AdvantageSim MD maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 5-20
MAPPING OF DICOM ENTITIES TO ADVANTAGESIM MD ENTITIES

DICOM IE	AdvantageSim MD Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

5.3 IOD MODULE TABLE

Within an entity of the DICOM PET Image Information Object Definition, attributes are grouped into a related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

The Positron Emission Tomography Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes.

TABLE 5-21
PET IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 3.4.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 3.4.2.1
	Patient Study	Used	See 3.4.2.2
	Clinical Trial Study	Not used.	N/A
Series	General Series	Used	See 3.4.3.1
	Clinical Trial Series	Not used	N/A
	PET Series	Used	See 5.4.1.1
	PET Isotope	Used	See 5.4.1.2
	PET Multi-gated Acquisition	Used - Required if Series Type (0054,1000) Value 1 is	

Entity Name	Module Name	Usage	Reference
		GATED	
	NM/PET Patient Orientation	Not used	N/A
Frame of Reference	Frame of Reference	Used	See 3.4.4
Equipment	General Equipment	Used	See 3.4.5.1
Image	General Image	Used	See 3.4.6.1
	Image Plane	Used	See 3.4.6.2
	Image Pixel	Used	See 3.4.6.3
	Device	Not used	N/A
	PET Image	Used	Se 5.4.2.1
	Overlay Plane	Not used	N/A
	VOI LUT	Not used	N/A
	Acquisition Context	Not used	N/A
	SOP Common	Used	See3.4.6.5

5.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the PET Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported and/or expected. Type 1 & Type 2 Attributes are also included for completeness and to define what the expected values when loading such instance are. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that the attributes are not present in tables are not supported.

5.4.1 Series Entity Modules

5.4.1.1 PET Series

TABLE 5-22: PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Series Date	(0008,0021)	1	Used.
Series Time	(0008,0031)	1	Used
Units	(0054,1001)	1	Used
Counts Source	(0054,1002)	1	Not used.
Series Type	(0054,1000)	1	Not used.
Reprojection Method	(0054,1004)	2C	Not used.
Number of R-R Intervals	(0054,0061)	1C	Not used.
Number of Time Slots	(0054,0071)	1C	Used if (0054,1000) Series Type is 'GATED'
Number of Time Slices	(0054,0101)	1C	Not used.
Number of Slices	(0054,0081)	1	Used
Corrected Image	(0028,0051)	2	Used
Randoms Correction Method	(0054,1100)	3	Not used.

Attribute Name	Tag	Type	Attribute Description
Attenuation Correction Method	(0054,1101)	3	Not used.
Scatter Correction Method	(0054,1105)	3	Not used.
Decay Correction	(0054,1102)	1	Not used.
Reconstruction Diameter	(0018,1100)	3	Not used.
Convolution Kernel	(0018,1210)	3	Not used.
Reconstruction Method	(0054,1103)	3	Not used.
Detector Lines of Response Used	(0054,1104)	3	Not used.
Acquisition Start Condition	(0018,0073)	3	Not used.
Acquisition Start Condition Data	(0018,0074)	3	Not used.
Acquisition Termination Condition	(0018,0071)	3	Not used.
Acquisition Termination Condition Data	(0018,0075)	3	Not used.
Field of View Shape	(0018,1147)	3	Not used.
Field of View Dimensions	(0018,1149)	3	Not used.
Gantry/Detector Tilt	(0018,1120)	3	Used. AdvantageSim rejects images with Gantry Tilt - see Image Orientation (Patient) attribute.
Gantry/Detector Slew	(0018,1121)	3	Used - Images with slew are rejected
Type of Detector Motion	(0054,0202)	3	Not used.
Collimator Type	(0018,1181)	2	Used
Collimator/Grid Name	(0018,1180)	3	Not used.
Axial Acceptance	(0054,1200)	3	Not used.
Axial Mash	(0054,1201)	3	Not used.
Transverse Mash	(0054,1202)	3	Not used.
Detector Element Size	(0054,1203)	3	Not used.
Coincidence Window Width	(0054,1210)	3	Not used.
Energy Window Range Sequence	(0054,0013)	3	Not used.
>Energy Window Lower Limit	(0054,0014)	3	Not used.
>Energy Window Upper Limit	(0054,0015)	3	Not used.
Secondary Counts Type	(0054,1220)	3	Not used.

5.4.1.2 PET Isotope

TABLE 5-23: PET ISOTOPE MODULE

Attribute Name	Tag	Type	Attribute Description
Radiopharmaceutical Information Sequence	(0054,0016)	2	Used
>Radionuclide Code Sequence	(0054,0300)	2	Not used
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	

Attribute Name	Tag	Type	Attribute Description
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Route	(0018,1070)	3	Not used
>Administration Route Code Sequence	(0054,0302)	3	Not used
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Volume	(0018,1071)	3	Not used
>Radiopharmaceutical Start Time	(0018,1072)	3	Used
>Radiopharmaceutical Stop Time	(0018,1073)	3	Not used
>Radionuclide Total Dose	(0018,1074)	3	Used
>Radionuclide Half Life	(0018,1075)	3	Used
>Radionuclide Positron Fraction	(0018,1076)	3	Not used
>Radiopharmaceutical Specific Activity	(0018,1077)	3	Not used
>Radiopharmaceutical	(0018,0031)	3	Not used
>Radiopharmaceutical Code Sequence	(0054,0304)	3	Not used
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Intervention Drug Information Sequence	(0018,0026)	3	Not used
>Intervention Drug Name	(0018,0034)	3	Not used
>Intervention Drug Code Sequence	(0018,0029)	3	Not used
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Intervention Drug Start Time	(0018,0035)	3	Not used
>Intervention Drug Stop Time	(0018,0027)	3	Not used
>Intervention Drug Dose	(0018,0028)	3	Not used

5.4.2 Image Entity Modules

5.4.2.1 PET Image Module

TABLE 5-24
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used. See 5.4.2.1.1
Samples per Pixel	(0028,0002)	1	Shall be 1
Photometric Interpretation	(0028,0004)	1	Shall be MONOCHROME2
Bits Allocated	(0028,0100)	1	Shall be 16
Bits Stored	(0028,0101)	1	Shall be 16

Attribute Name	Tag	Type	Attribute Description
High Bit	(0028,0102)	1	Not used, expected to be 15
Rescale Intercept	(0028,1052)	1	Not used, Shall be 0
Rescale Slope	(0028,1053)	1	Used
Frame Reference Time	(0054,1300)	1	Not used
Trigger Time	(0018,1060)	1C	Used
Frame Time	(0018,1063)	1C	Used
Low R-R Value	(0018,1081)	1C	Not used
High R-R Value	(0018,1082)	1C	Not used
Lossy Image Compression	(0028,2110)	1C	Used
Image Index	(0054,1330)	1	Used
Acquisition Date	(0008,0022)	2	Used
Acquisition Time	(0008,0032)	2	Used
Actual Frame Duration	(0018,1242)	2	Used
Nominal Interval	(0018,1062)	3	Not used
Intervals Acquired	(0018,1083)	3	Used
Intervals Rejected	(0018,1084)	3	Not used
Primary (Prompts) Counts Accumulated	(0054,1310)	3	Not used
Secondary Counts Accumulated	(0054,1311)	3	Not used
Slice Sensitivity Factor	(0054,1320)	3	Not used
Decay Factor	(0054,1321)	1C	Not used
Dose Calibration Factor	(0054,1322)	3	Not used
Scatter Fraction Factor	(0054,1323)	3	Not used
Dead Time Factor	(0054,1324)	3	Not used
Anatomic Region Sequence	(0008,2218)	3	Not used
> Include ‘Code Sequence Macro’			
> Anatomic Region Modifier Sequence	(0008,2220)	3	Not used
>> Include ‘Code Sequence Macro’			Defined Context ID is 2.
Primary Anatomic Structure Sequence	(0008,2228)	3	Not used
> Include ‘Code Sequence Macro’			
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not used
>> Include ‘Code Sequence Macro’			
Slice Progression Direction	(0054,0500)	3	Not used
View Code Sequence	(0054,0220)	3	Not used
> Include ‘Code Sequence Macro’			
> View Modifier Code Sequence	(0054,0222)	2C	
>> Include’ Code Sequence Macro’			

5.4.2.1.1 Image Type

The following values of Image Type (0008, 0008) are supported.

Specify which Enumerated Values of Value 1 are supported:

- ORIGINAL identifies an Original Image
- DERIVED identifies a Derived Image

Specify which Enumerated Values of Value 2 are supported:

- PRIMARY identifies a Primary Image

5.5 PRIVATE DATA

The following private elements are used:

TABLE 5- 25: PRIVATE ATTRIBUTES

Attribute Name	Tag	VR	VM	Type	Attribute Description
Private Creator	(0009, 00xx)	LO	1	3	GEMS_PETD_01: Used
Scan Time	(0009, xx0D)	DT	1	3	Used
Tracer Activity	(0009, xx38)	FL	1	3	Used
Measured Time	(0009, xx39)	DT	1	3	Used
Administrated Time	(0009, xx3B)	DT	1	3	Used
Post Injected Activity	(0009, xx3C)	FL	1	3	Used
Post Injected Time	(0009, xx3D)	DT	1	3	Used
Half Life	(0009, xx3F)	FL	1	3	Used
PET Phase Percentage	(0009,xxE3)	FL	1	3	Used
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used
Private User Data	(0047, xx11)	LT	1	3	Used
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used
Deformed Flag	(0059, xx00)	IS	1	3	Used

6 SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

6.1 INTRODUCTION

This section specifies the use of the DICOM Secondary Capture Image IOD to represent the information included in Secondary Capture images produced by this implementation. Corresponding attributes are conveyed using the module construct.

Note that the implementation described in this section relates to generation of SC Images by the AdvantageSim MD product only. The AdvantageSim MD application does not display SC Images directly, but relies on the Advantage Workstation and AW Server products for this function. SC Image conformance for Advantage Workstation and AW Server are described in the related documents *(See 1.6* References*).*

6.2 ADVANTAGESIM MD MAPPING OF DICOM ENTITIES

The AdvantageSim MD maps DICOM Information Entities to local Information Entities in the product's database and user interface.

TABLE 6-2 MAPPING OF DICOM ENTITIES TO ADVANTAGESIM MD ENTITIES

DICOM IE	AdvantageSim MD Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image

6.3 IOD MODULE TABLE

6.3.1 SC Image IOD Module Table

Within an entity of the DICOM SC Image Information Object Definition, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 6.3 IOD Module Table identifies the defined modules within the entities, which comprise the DICOM SC Image Information Object Definition. Modules are identified by Module Name.

See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

Note: The elements that are not listed in tables will not be present in generated images.

The Secondary Capture Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes.

TABLE 6-3 SC IMAGE IOD MODULES

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 6.4.1.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 6.4.2.1

Entity Name	Module Name	Usage	Reference
	Patient Study	Not used	N/A
	Clinical Trial Study	Not used	N/A
Series	General Series	Used	See 6.4.3.1
	Clinical Trial Series	Not used	N/A
Equipment	General Equipment	Used	See 6.4.4.1
	SC Equipment	Used	See 6.4.4.2
Image	General Image	Used	See 6.4.5.1
	Image Pixel	Used	See 6.4.5.2
	Device	Not used	N/A
	SC Image	Used	See 6.4.5.3
	Overlay Plane	Not used	N/A
	Modality LUT	Not used	N/A
	VOI LUT	Not used	N/A
	SOP Common	Used	See 6.4.5.4

6.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that attributes that are not present in tables are not supported.

6.4.1 Patient Entity Modules

6.4.1.1 Patient Module

TABLE 6-26
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Duplicated from patient model images. Non-empty patient's name required.
Patient ID	(0010,0020)	2	Duplicated from patient model images if present in those images, otherwise zero-length. S**trongly recommended for safe patient identification**.
Include ISSUER OF PATIENT ID MACRO. See TABLE 6-27			Duplicated from patient model images
Patient's Birth Date	(0010,0030)	2	Duplicated from patient model images
Patient's Sex	(0010,0040)	2	Duplicated from patient model images
Referenced Patient Sequence	(0008,1120)	3	Not generated
>Include 'SOP Instance Reference Macro'			
Patient's Birth Time	(0010,0032)	3	Duplicated from patient model images
Other Patient IDs	(0010,1000)	3	Duplicated from patient model images. Not copied

Attribute Name	Tag	Type	Attribute Description
			if empty
Other Patient IDs Sequence	(0010,1002)	3	Duplicated from patient model images
>Patient ID	(0010,0020)	1	Duplicated from patient model images
>Include ISSUER OF PATIENT ID MACRO See TABLE 6-27			Duplicated from patient model images
>Type of Patient ID	(0010,0022)	1	Duplicated from patient model images
Other Patient Names	(0010,1001)	3	Not generated
Ethnic Group	(0010,2160)	3	Not generated
Patient Comments	(0010,4000)	3	Not generated
Patient Species Description	(0010,2201)	1C	Not generated
Patient Species Code Sequence	(0010,2202)	1C	Not generated
>Include 'Code Sequence Macro'			
Patient Breed Description	(0010,2292)	2C	Not generated
Patient Breed Code Sequence	(0010,2293)	2C	Not generated
>Include 'Code Sequence Macro'			
Breed Registration Sequence	(0010,2294)	2C	Not generated
>Breed Registration Number	(0010,2295)	1	
>Breed Registry Code Sequence	(0010,2296)	1	
>>Include 'Code Sequence Macro'			
Responsible Person	(0010,2297)	2C	Not generated
Responsible Person Role	(0010,2298)	1C	Not generated
Responsible Organization	(0010,2299)	2C	Not generated
Patient Identity Removed	(0012,0062)	3	Not generated
De-identification Method	(0012,0063)	1C	Not generated
De-identification Method Code Sequence	(0012,0064)	1C	Not generated
>Include 'Code Sequence Macro'			

TABLE 6-27
ISSUER OF PATIENT ID MACRO

Attribute Name	Tag	Type	Attribute Description
Issuer of Patient ID	(0010,0021)	3	Duplicated from patient model images. Not copied if empty
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Duplicated from patient model images.
> Universal Entity ID	(0040,0032)	3	Duplicated from patient model images. Not copied if empty
> Universal Entity ID Type	(0040,0033)	1C	Duplicated from patient model images. Not copied if empty
> Identifier Type Code	(0040,0035)	3	Duplicated from patient model images. Not copied if empty

6.4.2 Study Entity Modules

6.4.2.1 General Study Module

TABLE 6-28
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Duplicated from patient model images
Study Date	(0008,0020)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Study Time	(0008,0030)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Referring Physician's Name	(0008,0090)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Referring Physician Identification Sequence	(0008,0096)	3	Not used
>Include 'Person Identification Macro'			
Study ID	(0020,0010)	2	Duplicated from patient model images (must be present in those images - see 3.4.2.1)
Accession Number	(0008,0050)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Study Description	(0008,1030)	3	If IHE compatibility option set then duplicated from patient model images, otherwise not generated.
Physician(s) of Record	(0008,1048)	3	Not used
Physician(s) of Record Identification Sequence	(0008,1049)	3	
>Include 'Person Identification Macro'			
Name of Physician(s) Reading Study	(0008,1060)	3	Not used
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	
>Include 'Person Identification Macro'			
Referenced Study Sequence	(0008,1110)	3	Not used
>Include 'SOP Instance Reference Macro'			
Procedure Code Sequence	(0008,1032)	3	Not used
>Include 'Code Sequence Macro'			

6.4.3 Series Entity Modules

6.4.3.1 General Series Module

TABLE 6-29
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	'OT'
Series Instance UID	(0020,000E)	1	New generated at every save
Series Number	(0020,0011)	2	Generated: '100'

Attribute Name	Tag	Type	Attribute Description
Laterality	(0020,0060)	2C	Not used
Series Date	(0008,0021)	3	Not generated
Series Time	(0008,0031)	3	Not generated
Performing Physicians' Name	(0008,1050)	3	Not generated
Performing Physician Identification Sequence	(0008,1052)	3	Not generated
>Include 'Person Identification Macro'			
Protocol Name	(0018,1030)	3	Not generated
Series Description	(0008,103E)	3	Generated: 'SC Image (Adv Sim)'
Operators' Name	(0008,1070)	3	Generated: Name of the operator is written if not empty
Operator Identification Sequence	(0008,1072)	3	Not generated
>Include 'Person Identification Macro'			
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Not generated
>Include 'SOP Instance Reference Macro'			
Related Series Sequence	(0008,1250)	3	Not generated
>Study Instance UID	(0020,000D)	1	
>Series Instance UID	(0020,000E)	1	
>Purpose of Reference Code Sequence	(0040,A170)	2	
>>Include 'Code Sequence Macro'			
Body Part Examined	(0018,0015)	3	Not generated
Patient Position	(0018,5100)	2C	Not generated
Smallest Pixel Value in Series	(0028,0108)	3	Not generated
Largest Pixel Value in Series	(0028,0109)	3	Not generated
Request Attributes Sequence	(0040,0275)	3	Not generated
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>> Include 'SOP Instance Reference Macro'			
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>>Include 'Code Sequence Macro'			
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>>Include' Code Sequence Macro'			
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
>>Protocol Context Sequence	(0040,0440)	3	
>>>Include 'Content Item Macro'			
>>>Content Item Modifier Sequence	(0040,0441)	3	
>>>>Include 'Content Item Macro'			
Performed Procedure Step ID	(0040,0253)	3	Not generated
Performed Procedure Step Start Date	(0040,0244)	3	Not generated
Performed Procedure Step Start Time	(0040,0245)	3	Not generated
Performed Procedure Step Description	(0040,0254)	3	Not generated
Performed Protocol Code Sequence	(0040,0260)	3	Not generated
>Include 'Code Sequence Macro'			
>>Protocol Context Sequence	(0040,0440)	3	
>>>Include 'Content Item Macro'			
>>>Content Item Modifier Sequence	(0040,0441)	3	
>> >>Include 'Content Item Macro'			
Comments on the Performed Procedure Step	(0040,0280)	3	Not generated

6.4.4 Equipment Entity Modules

6.4.4.1 General Equipment Module

TABLE 6-30
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	'GE MEDICAL SYSTEMS'
Institution Name	(0008,0080)	3	Not generated
Institution Address	(0008,0081)	3	Not generated
Station Name	(0008,1010)	3	<station hostname>
Institutional Department Name	(0008,1040)	3	Not generated
Manufacturer's Model Name	(0008,1090)	3	'AdvantageSim'
Device Serial Number	(0018,1000)	3	<station host ID>
Software Versions	(0018,1020)	3	8.<subversion>.<build>' (single-valued)
Gantry ID	(0018,1008)	3	Not generated
Spatial Resolution	(0018,1050)	3	Not generated
Date of Last Calibration	(0018,1200)	3	Not generated
Time of Last Calibration	(0018,1201)	3	Not generated
Pixel Padding Value	(0028,0120)	1C	Not generated

6.4.4.2 SC Equipment Module

TABLE 6-31
SC EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	'WSD' = Workstation

Modality	(0008,0060)	3	'OT'
Secondary Capture Device ID	(0018,1010)	3	<station host ID>
Secondary Capture Device Manufacturer	(0018,1016)	3	'GE MEDICAL SYSTEMS'
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	'AdvantageSim'
Secondary Capture Device Software Version	(0018,1019)	3	'8.<subversion>.<build>'
Video Image Format Acquired	(0018,1022)	3	Not used
Digital Image Format Acquired	(0018,1023)	3	Not used

6.4.5 Image Entity Modules

6.4.5.1 General Image Module

TABLE 6-32
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Generated number
Patient Orientation	(0020,0020)	2C	Zero-length
Content Date	(0008,0023)	2C	Date when Secondary Capture Image was created.
Content Time	(0008,0033)	2C	Time when Secondary Capture Image was created.
Image Type	(0008,0008)	3	'DERIVED\SECONDARY' (Value 3 and Value 4 not supplied)
Acquisition Number	(0020,0012)	3	Not generated
Acquisition Date	(0008,0022)	3	Not generated
Acquisition Time	(0008,0032)	3	Not generated
Acquisition DateTime	(0008,002A))	3	Not generated
Referenced Image Sequence	(0008,1140)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
Derivation Description	(0008,2111)	3	Not generated
Derivation Code Sequence	(0008,9215)	3	Not generated
>Include 'Code Sequence Macro'			
Source Image Sequence	(0008,2112)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
>Spatial Locations Preserved	(0028,135A)	3	
>Patient Orientation	(0020,0020)	1C	
Referenced Instance Sequence	(0008,114A)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
Images in Acquisition	(0020,1002)	3	Not generated
Image Comments	(0020,4000)	3	'Plan_name (Plan_date_time)' where Plan_name is the Plan Label of the referenced RT Plan, and Plan_date_time is the save date/ time of referenced RT Plan
Quality Control Image	(0028,0300)	3	Not generated
Burned In Annotation	(0028,0301)	3	Generated: 'YES'
Lossy Image Compression	(0028,2110)	3	Not generated
Lossy Image Compression Ratio	(0028,2112)	3	Not generated
Lossy Image Compression Method	(0028,2114)	3	Not generated
Icon Image Sequence	(0088,0200)	3	Not generated
>Include 'Image Pixel Macro'		Not used.	
Presentation LUT Shape	(2050,0020)	3	Not generated

6.4.5.2 Image Pixel Module

TABLE 6-33
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	One sample per pixel
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'
Rows	(0028,0010)	1	512 (quarter-screen image) or 1024 (full-screen image)
Columns	(0028,0011)	1	512 (quarter-screen image) or 1024 (full-screen image)
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Overlaid data in AdvantageSim MD image display (e.g. on-screen annotations, geometrical structures and beam edges) are converted into monochrome, 'burned in' to the image (i.e. obscure the image pixels) and transmitted as part of Pixel Data
Planar Configuration	(0028,0006)	1C	Not generated
Pixel Aspect Ratio	(0028,0034)	1C	Not generated
Smallest Image Pixel Value	(0028,0106)	3	Not generated
Largest Image Pixel Value	(0028,0107)	3	Not generated
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not generated
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not generated

Attribute Name	Tag	Type	Attribute Description
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not generated
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not generated.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not generated.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not generated.
ICC Profile	(0028,2000)	3	Not generated.
Pixel Data Provider URL	(0028,7FE0)	1C	Not generated.
Pixel Padding Range Limit	(0028,0121)	1C	Not generated.

6.4.5.3 SC Image Module

TABLE 6-34
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Date when Secondary Capture Image was created.
Time of Secondary Capture	(0018,1014)	3	Time when Secondary Capture Image was created.

6.4.5.4 SOP Common Module

TABLE 6-35
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	'1.2.840.10008.5.1.4.1.1.7'
SOP Instance UID	(0008,0018)	1	UID root will be '1.2.840.113619.6.196'
Specific Character Set	(0008,0005)	1C	'ISO_IR 100'
Instance Creation Date	(0008,0012)	3	Date when Secondary Capture Image was created.
Instance Creation Time	(0008,0013)	3	Time when Secondary Capture Image was created.
Instance Creator UID	(0008,0014)	3	'1.2.840.113619.6.196'
Related General SOP Class UID	(0008,001A)	3	Not generated
Original Specialized SOP Class UID	(0008,001B)	3	Not generated
Coding Scheme Identification Sequence	(0008,0110)	3	Not generated
>Coding Scheme Designator	(0008,0102)	1	
>Coding Scheme Registry	(0008,0112)	1C	
>Coding Scheme UID	(0008,010C)	1C	
>Coding Scheme External ID	(0008,0114)	2C	
>Coding Scheme Name	(0008,0115)	3	
>Coding Scheme Version	(0008,0103)	3	
>Coding Scheme Responsible Organization	(0008,0116)	3	
Timezone Offset From UTC	(0008,0201)	3	Not generated
Contributing Equipment Sequence	(0018,A001)	3	Not generated
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			

Attribute Name	Tag	Type	Attribute Description
>Manufacturer	(0008,0070)	1	
>Institution Name	(0008,0080)	3	
>Institution Address	(0008,0081)	3	
>Station Name	(0008,1010)	3	
>Institutional Department Name	(0008,1040)	3	
>Manufacturer's Model Name	(0008,1090)	3	
>Device Serial Number	(0018,1000)	3	
>Software Versions	(0018,1020)	3	
>Spatial Resolution	(0018,1050)	3	
>Date of Last Calibration	(0018,1200)	3	
>Time of Last Calibration	(0018,1201)	3	
>Contribution DateTime	(0018,A002)	3	
>Contribution Description	(0018,A003)	3	
Instance Number	(0020,0013)	3	See General Image Module
SOP Instance Status	(0100,0410)	3	Not generated
SOP Authorization Date and Time	(0100,0420)	3	Not generated
SOP Authorization Comment	(0100,0424)	3	Not generated
Authorization Equipment Certification Number	(0100,0426)	3	Not generated
MAC Parameters Sequence	(4FFE,0001)	3	Not generated
>MAC ID Number	(0400,0005)	1	
>MAC Calculation Transfer Syntax UID	(0400,0010)	1	
>MAC Algorithm	(0400,0015)	1	
>Data Elements Signed	(0400,0020)	1	
Digital Signatures Sequence	(FFFA,FFFA)	3	Not generated
>MAC ID Number	(0400,0005)	1	
>Digital Signature UID	(0400,0100)	1	
>Digital Signature DateTime	(0400,0105)	1	
>Certificate Type	(0400,0110)	1	
>Certificate of Signer	(0400,0115)	1	
>Signature	(0400,0120)	1	
>Certified Timestamp Type	(0400,0305)	1C	
>Certified Timestamp	(0400,0310)	3	
>Digital Signature Purpose Code Sequence	(0400,0401)	3	
>>Include 'Code Sequence Macro'			
Encrypted Attributes Sequence	(0400,0500)	1C	Not generated
>Encrypted Content Transfer Syntax UID	(0400,0510)	1	
>Encrypted Content	(0400,0520)	1	
Original Attributes Sequence	(0400,0561)	3	Not generated

Attribute Name	Tag	Type	Attribute Description
>Source of Previous Values	(0400,0564)	2	
>Attribute Modification DateTime	(0400,0562)	1	
>Modifying System	(0400,0563)	1	
>Reason for the Attribute Modification	(0400,0565)	1	
>Modified Attributes Sequence	(0400,0550)	1	
>>Any Attribute from the main data set that was modified or removed; may include Sequence Attributes and their Items.			
HL7 Structured Document Reference Sequence	(0040,A390)	1C	Not generated
>Referenced SOP Class UID	(0008,1150)	1	
>Referenced SOP Instance UID	(0008,1155)	1	
>HL7 Instance Identifier	(0040,E001)	1	
>Retrieve URI	(0040,E010)	3	

7 RT IMAGE INFORMATION OBJECT IMPLEMENTATION

7.1 INTRODUCTION

This section specifies the use of the DICOM RT Image IOD to represent the information included in images produced by this implementation. Only Single Frame RT Images may be generated. Corresponding attributes are conveyed using the module construct.

7.2 RT IMAGE IOD IMPLEMENTATION

This section defines the implementation of the RT Image information object in the AdvantageSim application. It refers to the DICOM Standard, Part 3 (Information Object Definitions). The AdvantageSim MD application does not display RT Images directly, but relies on the Advantage Workstation product for this function.

7.2.1 Entities Description

Refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the RT Image information object.

7.2.2 AdvantageSim Mapping of DICOM entities

DICOM entities map to the AdvantageSim entities in the following manner:

DICOM	AdvantageSim
Patient Entity	Patient Entity
Study Entity	Examination Entity
Series Entity	Series Entity
Frame of Reference Entity	No mapping
Equipment Entity	Equipment on which AdvantageSim application is running
Image Entity	Screen Save of *DRR (digitally-reconstructed radiograph) image only* (generated from within application using AdvantageSim menu option in main panel). AdvantageSim does not directly display RT Images.

7.3 RT IMAGE IOD MODULE TABLE

Within an entity of the DICOM RT Image Information Object Definition, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 7-36 RT IMAGE IOD MODULENFORMATION OBJECT DEFINITION identifies the defined modules within the entities, which comprise the DICOM RT Image Information Object Definition. Modules are identified by Module Name.

See DICOM Standard Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 7-36: RT IMAGE IOD MODULE

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 7.4.1.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 7.4.2.1 0
	Patient Study	Not used	N/A
	Clinical Trial Study	Not used	N/A
Series	RT Series	Used	See 7.4.3.1
	Clinical Trial Series	Not used	N/A
Frame of Reference	Frame of Reference	Not used	N/A
Equipment	General Equipment	Used	See 7.4.3.2
Image	General Image	Used	See 7.4.4.1
	Image Pixel	Used	See 7.4.4.2
	Contrast/bolus	Not used	N/A
	Cine	Not used	N/A
	Multi-Frame	Not used	N/A
	Device	Not used	N/A
	RT Image	Used	See 7.4.4.3
	Modality LUT	Not used	N/A
	VOI LUT	Not used	N/A
	Approval	Not used	N/A
	SOP Common	Used	See 7.4.4.4

7.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the RT Image Information Object.

Note: The elements that are not listed in tables will not be present in generated images.

7.4.1 Patient Entity Modules

7.4.1.1 Patient Module

TABLE 7-37
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Non-empty patient name required. Duplicated from patient model images
Patient ID	(0010,0020)	2	Duplicated from patient model images **Strongly**

Attribute Name	Tag	Type	Attribute Description
			recommended for safe patient identification.
ISSUER OF PATIENT ID MACRO. See TABLE 7-38			Duplicated from patient model images
Patient's Birth Date	(0010,0030)	2	Duplicated from patient model images
Patient's Sex	(0010,0040)	2	Duplicated from patient model images
Referenced Patient Sequence	(0008,1120)	3	Not generated
>Include 'SOP Instance Reference Macro'			
Patient's Birth Time	(0010,0032)	3	Duplicated from patient model images
Other Patient IDs	(0010,1000)	3	Duplicated from patient model images. Not copied if empty
Other Patient IDs Sequence	(0010,1002)	3	Duplicated from patient model images
>Patient ID	(0010,0020)	1	Duplicated from patient model images
ISSUER OF PATIENT ID MACRO. See TABLE 7-38			Duplicated from patient model images
>Type of Patient ID	(0010,0022)	1	Duplicated from patient model images
Other Patient Names	(0010,1001)	3	Not generated
Ethnic Group	(0010,2160)	3	Not generated
Patient Comments	(0010,4000)	3	Not generated
Patient Species Description	(0010,2201)	1C	Not generated
Patient Species Code Sequence	(0010,2202)	1C	Not generated
>Include 'Code Sequence Macro'			
Patient Breed Description	(0010,2292)	2C	Not generated
Patient Breed Code Sequence	(0010,2293)	2C	Not generated
>Include 'Code Sequence Macro'			
Breed Registration Sequence	(0010,2294)	2C	Not generated
>Breed Registration Number	(0010,2295)	1	
>Breed Registry Code Sequence	(0010,2296)	1	
>>Include 'Code Sequence Macro'			
Responsible Person	(0010,2297)	2C	Not generated
Responsible Person Role	(0010,2298)	1C	Not generated
Responsible Organization	(0010,2299)	2C	Not generated
Patient Identity Removed	(0012,0062)	3	Not generated
De-identification Method	(0012,0063)	1C	Not generated
De-identification Method Code Sequence	(0012,0064)	1C	Not generated
>Include 'Code Sequence Macro'			

TABLE 7-38
ISSUER OF PATIENT ID MACRO

Attribute Name	Tag	Type	Attribute Description
Issuer of Patient ID	(0010,0021)	3	Duplicated from patient model images. Not copied if empty
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Duplicated from patient model images
> Universal Entity ID	(0040,0032)	3	Duplicated from patient model images. Not copied

Attribute Name	Tag	Type	Attribute Description
			if empty
> Universal Entity ID Type	(0040,0033)	1C	Duplicated from patient model images. Not copied if empty
> Identifier Type Code	(0040,0035)	3	Duplicated from patient model images. Not copied if empty

7.4.2 Study Entity Modules

7.4.2.1 General study module

TABLE 7-39
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Duplicated from patient model images
Study Date	(0008,0020)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Study Time	(0008,0030)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Referring Physician's Name	(0008,0090)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Referring Physician Identification Sequence	(0008,0096)	3	Not generated
>Include 'Person Identification Macro'			
Study ID	(0020,0010)	2	Duplicated from patient model images (must be present in those images - see 3.4.2.1)
Accession Number	(0008,0050)	2	Duplicated from patient model images if present in those images, otherwise zero-length
Study Description	(0008,1030)	3	If IHE compatibility option set then duplicated from patient model images, otherwise not generated.
Physician(s) of Record	(0008,1048)	3	Not generated
Physician(s) of Record Identification Sequence	(0008,1049)	3	Not generated
>Include 'Person Identification Macro'			
Name of Physician(s) Reading Study	(0008,1060)	3	Not generated
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	Not generated
>Include 'Person Identification Macro'			
Referenced Study Sequence	(0008,1110)	3	Not generated
>Include 'SOP Instance Reference Macro'			
Procedure Code Sequence	(0008,1032)	3	Not generated
>Include 'Code Sequence Macro'			

7.4.3 Series Entity Modules

7.4.3.1 RT Series

TABLE 7-40: RT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Generated: 'RTIMAGE'
Series Instance UID	(0020,000E)	1	New generated at every save
Series Number	(0020,0011)	2	Generated: '101'
Series Description	(0008,103E)	3	Generated: 'AdvantageSim RT Images'
Operator's Name	(0008,1070)	2	Generated: Name of the operator defined at last plan save.
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Not generated
>Include 'SOP Instance Reference Macro'			
Request Attributes Sequence	(0040,0275)	3	Not generated
>Include Request Attributes Macro			
Include Performed Procedure Step Summary Macro			Not generated

7.4.3.2 General Equipment Module

TABLE 7-41: GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	'GE MEDICAL SYSTEMS'
Institution Name	(0008,0080)	3	Not generated
Institution Address	(0008,0081)	3	Not generated
Station Name	(0008,1010)	3	<station hostname>
Institutional Department Name	(0008,1040)	3	Not generated
Manufacturer's Model Name	(0008,1090)	3	'AdvantageSim'
Device Serial Number	(0018,1000)	3	<station host ID>
Software Versions	(0018,1020)	3	8.<subversion>.<build>' (single-valued)
Gantry ID	(0018,1008)	3	Not generated
Spatial Resolution	(0018,1050)	3	Not generated
Date of Last Calibration	(0018,1200)	3	Not generated
Time of Last Calibration	(0018,1201)	3	Not generated
Pixel Padding Value	(0028,0120)	1C	Not generated

7.4.4 Image Entity Modules

7.4.4.1 General Image Module

TABLE 7-42
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Generated number
Patient Orientation	(0020,0020)	2C	Zero-length

Attribute Name	Tag	Type	Attribute Description
Content Date	(0008,0023)	2C	Date when RT Image was created.
Content Time	(0008,0033)	2C	Time when RT Image was created.
Image Type	(0008,0008)	3	'DERIVED\SECONDARY' (Value 3 and Value 4 not supplied)
Acquisition Number	(0020,0012)	3	Not generated
Acquisition Date	(0008,0022)	3	Not generated
Acquisition Time	(0008,0032)	3	Not generated
Acquisition DateTime	(0008,002A))	3	Not generated
Referenced Image Sequence	(0008,1140)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
Derivation Description	(0008,2111)	3	Not generated
Derivation Code Sequence	(0008,9215)	3	Not generated
>Include 'Code Sequence Macro'			
Source Image Sequence	(0008,2112)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	3	
>>Include 'Code Sequence Macro'			
>Spatial Locations Preserved	(0028,135A)	3	
>Patient Orientation	(0020,0020)	1C	
Referenced Instance Sequence	(0008,114A)	3	Not generated
>Include 'SOP Instance Reference Macro'			
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			
Images in Acquisition	(0020,1002)	3	Not generated
Image Comments	(0020,4000)	3	'Plan_name (Plan_date_time)' where Plan_name is the Plan Label of the referenced RT Plan, and Plan_date_time is the save date/ time of referenced RT Plan
Quality Control Image	(0028,0300)	3	Not generated
Burned In Annotation	(0028,0301)	3	Not generated
Lossy Image Compression	(0028,2110)	3	Not generated
Lossy Image Compression Ratio	(0028,2112)	3	Not generated
Lossy Image Compression Method	(0028,2114)	3	Not generated
Icon Image Sequence	(0088,0200)	3	Not generated
>Include 'Image Pixel Macro'		Not used	
Presentation LUT Shape	(2050,0020)	3	Not generated

7.4.4.2 Image Pixel Module

TABLE 7-43: IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	One sample per pixel
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'
Rows	(0028,0010)	1	512 (quarter-screen image) or 1024 (full-screen image)
Columns	(0028,0011)	1	512 (quarter-screen image) or 1024 (full-screen image)
Bits Allocated	(0028,0100)	1	8
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0
Pixel Data	(7FE0,0010)	1	Overlaid data in AdvantageSim MD image display (e.g. on-screen annotations, geometrical structures and beam edges) are converted into monochrome, 'burned in' to the image (i.e. obscure the image pixels) and transmitted as part of Pixel Data
Planar Configuration	(0028,0006)	1C	Not generated
Pixel Aspect Ratio	(0028,0034)	1C	Not generated
Smallest Image Pixel Value	(0028,0106)	3	Not generated
Largest Image Pixel Value	(0028,0107)	3	Not generated
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not generated
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not generated
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not generated
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not generated.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not generated.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not generated.
ICC Profile	(0028,2000)	3	Not generated.
Pixel Data Provider URL	(0028,7FE0)	1C	Not generated.
Pixel Padding Range Limit	(0028,0121)	1C	Not generated.

7.4.4.3 RT Image Module

TABLE 7-44: RT IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'
RT Image Label	(3002,0002)	1	Name of associated beam in referenced RT Plan
RT Image Name	(3002,0003)	3	'*Plan_name* (*Plan_date_time*)' where *Plan_name* is the Plan Label of the referenced RT Plan, and *Plan_date_time* is the save date/time of referenced RT Plan
Bits Allocated	(0028,0100)	1	8

Attribute Name	Tag	Type	Attribute Description
Bits Stored	(0028,0101)	1	8
High Bit	(0028,0102)	1	7
Pixel Representation	(0028,0103)	1	0000H
Image Type	(0008,0008)	1	'DERIVED\SECONDARY\DRR'
Conversion Type	(0008,0064)	2	'WSD'
RT Image Plane	(3002,000C)	1	'NORMAL'
X-Ray Image Receptor Angle	(3002,000E)	2	0
Image Plane Pixel Spacing	(3002,0011)	2	Pixels will always be square
RT Image Position	(3002,0012)	2	First pixel transmitted always has negative x and positive y values (i.e. image viewed from treatment machine gantry with eyes fixed along gantry X axis and top of head towards gantry wall)
Radiation Machine Name	(3002,0020)	2	Name (including suffix) of machine associated with beam in AdvantageSim
Primary Dosimeter Unit	(300A,00B3)	2	Zero-length
Radiation Machine SAD	(3002,0022)	2	Source-axis distance of machine associated with beam in AdvantageSim
RT Image SID	(3002,0026)	2	Equal to SAD of machine associated with beam in AdvantageSim (i.e. image is always projected onto isocenter)
Referenced RT Plan Sequence	(300C,0002)	3	References RT Plan stored immediately before screen save was performed in AdvantageSim. If last saved RT Plan has been subsequently modified in AdvantageSim application, screen save option shall be inhibited.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.5.1.4.1.1.481.5' (RT Plan)
>Referenced SOP Instance UID	(0008,1155)	1C	SOP Instance UID of referenced RT Plan
Referenced Beam Number	(300C,0006)	3	Beam Number of beam in referenced RT Plan
Exposure Sequence	(3002,0030)	3	One exposure parameter set is included
>Beam Limiting Device Sequence	(300A,00B6)	3	Sequence will always contain two or three(add-on MLC) items
>>RT Beam Limiting Device Type	(300A, 00B8)	1C	Will be 'X', 'Y', 'ASYMX', 'ASYMY', 'MLCX' or 'MLCY', according to collimator type of machine associated with beam in AdvantageSim
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1C	For 'MLCX' or 'MLCY' collimators, equal to the number of leaf pairs in the MLC collimator jaw of the machine associated with beam in AdvantageSim, for 'X', 'Y', 'ASYMX', 'ASYMY' equals to 1.
>>Leaf Position Boundaries	(300A,00BE)	2C	Provided only for 'MLCX' and 'MLCY' collimators
>>Leaf/Jaw Positions	(300A,011C)	1	Positions of beam limiting device leaf /jaw pairs
>Number of Blocks	(300A,00F0)	1	Number of blocks or cutouts defined for beam in AdvantageSim
>Block Sequence	(300A,00F4)	2C	It is sent if Number Of Blocks is greater than 0. 1-N items may be included.
>> Source to Block Tray Distance	(300A,00F6)	2	Source to Block Tray Distance obtained from machine associated with beam in AdvantageSim
>>Block Type	(300A,00F8)	1	'SHIELDING' or 'APERTURE'

Attribute Name	Tag	Type	Attribute Description
>>Block Divergence	(300A,00FA)	2	Zero-length
>>Block Number	(300A,00FC)	1	Blocks will be numbered from 1 to n in order presented in sequence
>>Block Name	(300A,00FE)	3	Name of block or cutout defined in AdvantageSim
>>Material ID	(300A,00E1)	2	Zero-length
>>Block Number of Points	(300A,0104)	2	In AdvantageSim there is no software limit imposed on the number of points in a block shape
>>Block Data	(300A,0106)	2	(x,y) coordinates of block edges
Gantry Angle	(300A,011E)	3	Gantry angle of the associated beam
Beam Limiting Device Angle	(300A,0120)	3	Collimator angle of the associated beam
Patient Support Angle	(300A,0122)	3	Tabel Angle of the associated beam

7.4.4.4 SOP Common Module

TABLE 7-45
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	'1.2.840.10008.5.1.4.1.1.481.1'
SOP Instance UID	(0008,0018)	1	UID root will be '1.2.840.113619.6.196'
Specific Character Set	(0008,0005)	1C	'ISO_IR 100'
Instance Creation Date	(0008,0012)	3	Date when RT Image was created.
Instance Creation Time	(0008,0013)	3	Time when RT Image was created.
Instance Creator UID	(0008,0014)	3	'1.2.840.113619.6.196'
Related General SOP Class UID	(0008,001A)	3	Not generated
Original Specialized SOP Class UID	(0008,001B)	3	Not generated
Coding Scheme Identification Sequence	(0008,0110)	3	Not generated
>Coding Scheme Designator	(0008,0102)	1	
>Coding Scheme Registry	(0008,0112)	1C	
>Coding Scheme UID	(0008,010C)	1C	
>Coding Scheme External ID	(0008,0114)	2C	
>Coding Scheme Name	(0008,0115)	3	
>Coding Scheme Version	(0008,0103)	3	
>Coding Scheme Responsible Organization	(0008,0116)	3	
Timezone Offset From UTC	(0008,0201)	3	Not generated
Contributing Equipment Sequence	(0018,A001)	3	Not generated
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	1	
>Institution Name	(0008,0080)	3	
>Institution Address	(0008,0081)	3	
>Station Name	(0008,1010)	3	

Attribute Name	Tag	Type	Attribute Description
>Institutional Department Name	(0008,1040)	3	
>Manufacturer's Model Name	(0008,1090)	3	
>Device Serial Number	(0018,1000)	3	
>Software Versions	(0018,1020)	3	
>Spatial Resolution	(0018,1050)	3	
>Date of Last Calibration	(0018,1200)	3	
>Time of Last Calibration	(0018,1201)	3	
>Contribution DateTime	(0018,A002)	3	
>Contribution Description	(0018,A003)	3	
Instance Number	(0020,0013)	3	See General Image Module
SOP Instance Status	(0100,0410)	3	Not generated
SOP Authorization Date and Time	(0100,0420)	3	Not generated
SOP Authorization Comment	(0100,0424)	3	Not generated
Authorization Equipment Certification Number	(0100,0426)	3	Not generated
MAC Parameters Sequence	(4FFE,0001)	3	Not generated
>MAC ID Number	(0400,0005)	1	
>MAC Calculation Transfer Syntax UID	(0400,0010)	1	
>MAC Algorithm	(0400,0015)	1	
>Data Elements Signed	(0400,0020)	1	
Digital Signatures Sequence	(FFFA,FFFA)	3	Not generated
>MAC ID Number	(0400,0005)	1	
>Digital Signature UID	(0400,0100)	1	
>Digital Signature DateTime	(0400,0105)	1	
>Certificate Type	(0400,0110)	1	
>Certificate of Signer	(0400,0115)	1	
>Signature	(0400,0120)	1	
>Certified Timestamp Type	(0400,0305)	1C	
>Certified Timestamp	(0400,0310)	3	
>Digital Signature Purpose Code Sequence	(0400,0401)	3	
>>Include 'Code Sequence Macro'			
Encrypted Attributes Sequence	(0400,0500)	1C	
>Encrypted Content Transfer Syntax UID	(0400,0510)	1	
>Encrypted Content	(0400,0520)	1	
Original Attributes Sequence	(0400,0561)	3	Not generated
>Source of Previous Values	(0400,0564)	2	
>Attribute Modification DateTime	(0400,0562)	1	
>Modifying System	(0400,0563)	1	
>Reason for the Attribute	(0400,0565)	1	

Attribute Name	Tag	Type	Attribute Description
Modification			
>Modified Attributes Sequence	(0400,0550)	1	
>>Any Attribute from the main data set that was modified or removed; may include Sequence Attributes and their Items.			
HL7 Structured Document Reference Sequence	(0040,A390)	1C	Not generated
>Referenced SOP Class UID	(0008,1150)	1	
>Referenced SOP Instance UID	(0008,1155)	1	
>HL7 Instance Identifier	(0040,E001)	1	
>Retrieve URI	(0040,E010)	3	

8 RT STRUCTURE SET INFORMATION OBJECT IMPLEMENTATION

8.1 INTRODUCTION

This section specifies the use of the DICOM RT Structure Set IOD to represent the information included in structure sets produced by this implementation, and also specifies the requirements for the RT Structure Set IOD when being used as input to AdvantageSim. Corresponding attributes are conveyed using the module construct.

AdvantageSim implements the RT Structure Set IOD as a Standard Extended object, containing seven additional elements defined in the Structure Set Module (**see Section 8.4.4.1 of this document**). These attributes are:

- In the Structure Set Module, top level:
  - Couch Removal Status (0249, xxE0), indicating if the treatment couch had been removed by the AdvantageSim software;
  - View Layout (0249,xxE1), storing the arrangement of views;
  - Planar View Windowing (0249, xxE2), the display parameters for the 2D non-DRR views.
  - Remove Couch plane's coordinates (0249,xxE6), if the treatment couch had been removed by the AdvantageSim software (See (0249,xxE0)), this value stores the coordinate used for treatment couch removal on Axial view.
- In the Structure Set Module, Structure Set ROI Sequence:
  - ROI Generation Thresholds (0249,xxE3)
  - ROI Bridge Removal Pixels (0249,xxE4), storing the generation parameters for automatically generated structures.
  - Auto-segmentation description (0249,xxE8) storing generation description for auto-segmented structures
  - In the Referenced Frame of Reference Sequence:
  - 3D Model name (0249, xxE5), storing the unique 3D model name assigned for each series.

These attributes are provided for enhanced functionality when reading RT Structure Sets created by the AdvantageSim application itself. They should be ignored by SCP implementations interpreting these objects. These attributes are not required in RT Structure Sets created by SCU implementations for use in AdvantageSim.

8.2 RT STRUCTURE SET IOD IMPLEMENTATION

This section defines the implementation of the RT Structure Set information object in the AdvantageSim application. It refers to the DICOM Standard Part 3 (Information Object Definitions).

In the following tables, notes are provided for when AdvantageSim is acting as a producer of objects (SCU), and a consumer of objects (SCP). Notes in UPPER CASE LETTERS represent restrictions on object contents imposed by AdvantageSim when acting as an SCP (object consumer).

8.2.1 AdvantageSim Mapping of DICOM entities

DICOM entities map to the AdvantageSim entities in the following manner:

DICOM	AdvantageSim
Patient Entity	Patient Entity
Study Entity	Examination Entity
Series Entity	Series Entity
Equipment Entity	Workstation on which AdvantageSim application is running
Structure Set	AdvantageSim geometric information relating to defined structures and markers

8.3 RT STRUCTURE SET IOD MODULE TABLE

Within an entity of the DICOM RT Structure Set Information Object Definition, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

TABLE 8-4 identifies the defined modules within the entities, which comprise the DICOM RT Structure Set Information Object Definition. Modules are identified by Module Name.

See DICOM Standard Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 8-4 RT STRUCTURE SET INFORMATION OBJECT DEFINITION (IOD) MODULE TABLE

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 8.4.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 8.4.2
	Patient Study	Not used	N/A
	Clinical Trial Study	Not used	N/A
Series	RT Series	Used	See 8.4.3.1
	Clinical Trial Series	Not used	N/A
Equipment	General Equipment	Used	See 8.4.3.2
Structure Set	Structure Set	Used	See 8.4.4.1
	ROI Contour	Used	See 8.4.4.2
	RT ROI Observations	Used	See 8.4.4.3
	Approval	Not used	N/A
	SOP Common	Used	See 8.4.4.4

8.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the RT Structure Set Information Object.

Note: The elements that are not listed in tables will not be present in generated images.

8.4.1 Patient Entity Modules

TABLE 8-46
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	SCU: Duplicated from patient model images SCP: NON-NULL VALUE REQUIRED BY ADVANTAGESIM FOR SAFE PATIENT IDENTIFICATION
Patient ID	(0010,0020)	2	SCU: Duplicated from patient model images SCP: NON-NULL VALUE STRONGLY RECOMMENDED FOR SAFE PATIENT
ISSUER OF PATIENT ID MACRO. See Table 8-47			SCP: Read/SCU: copied
Patient's Birth Date	(0010,0030)	2	SCP: Used/SCU: copied. On AW 4.6 may be used for database key if non-null. Use of identical value to that found in acquisition images is recommended
Patient's Sex	(0010,0040)	2	SCP: Used/SCU: copied. On AW 4.6 may be used for database key if non-null. Use of identical value to that found in acquisition images is recommended
Referenced Patient Sequence	(0008,1120)	3	SCP: Not used/SCU: not copied
>Include 'SOP Instance Reference Macro'			
Patient's Birth Time	(0010,0032)	3	SCP: Used/SCU: Duplicated from patient model images. On AW 4.6 may be used for database key if non-null. Use of identical value to that found in acquisition images is recommended
Other Patient IDs	(0010,1000)	3	SCP: Read/SCU: Duplicated from patient model images. Not copied if empty
Other Patient IDs Sequence	(0010,1002)	3	SCP: Read/SCU: Duplicated from patient model images
>Patient ID	(0010,0020)	1	SCP: Read/SCU: Duplicated from patient model images
> ISSUER OF PATIENT ID MACRO. See Table 8-47			SCP: Read/SCU: Duplicated from patient model images
>Type of Patient ID	(0010,0022)	1	SCP: Read/SCU: Duplicated from patient model images
Other Patient Names	(0010,1001)	3	SCP: Not used/SCU: not generated
Ethnic Group	(0010,2160)	3	SCP: Not used/SCU: not generated
Patient Comments	(0010,4000)	3	SCP: Not used/SCU: not generated
Patient Species Description	(0010,2201)	1C	SCP: Not used/SCU: not generated
Patient Species Code Sequence	(0010,2202)	1C	SCP: Not used/SCU: not generated
>Include 'Code Sequence Macro'			
Patient Breed Description	(0010,2292)	2C	SCP: Not used/SCU: not generated

Attribute Name	Tag	Type	Attribute Description
Patient Breed Code Sequence	(0010,2293)	2C	SCP: Not used/SCU: not generated
>Include 'Code Sequence Macro'			
Breed Registration Sequence	(0010,2294)	2C	SCP: Not used/SCU: not generated
>Breed Registration Number	(0010,2295)	1	
>Breed Registry Code Sequence	(0010,2296)	1	
>>Include 'Code Sequence Macro'			
Responsible Person	(0010,2297)	2C	SCP: Not used/SCU: not generated
Responsible Person Role	(0010,2298)	1C	SCP: Not used/SCU: not generated
Responsible Organization	(0010,2299)	2C	SCP: Not used/SCU: not generated
Patient Identity Removed	(0012,0062)	3	SCP: Not used/SCU: not generated
De-identification Method	(0012,0063)	1C	SCP: Not used/SCU: not generated
De-identification Method Code Sequence	(0012,0064)	1C	SCP: Not used/SCU: not generated
>Include 'Code Sequence Macro'			

TABLE 8-47
ISSUER OF PATIENT ID MACRO

Attribute Name	Tag	Type	Attribute Description
Issuer of Patient ID	(0010,0021)	3	SCP: Read/SCU: Duplicated from patient model images. Not copied if empty
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	SCP: Read/SCU: Duplicated from patient model images.
> Universal Entity ID	(0040,0032)	3	SCP: Read/SCU: Duplicated from patient model images. Not copied if empty
> Universal Entity ID Type	(0040,0033)	1C	SCP: Read/SCU: Duplicated from patient model images. Not copied if empty
> Identifier Type Code	(0040,0035)	3	SCP: Read/SCU: Duplicated from patient model images. Not copied if empty

8.4.2 General Study Entity Modules

TABLE 8-48
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	SCP: Used, SCU: Duplicated from patient model images
Study Date	(0008,0020)	2	SCP: Used, SCU: Duplicated from patient model images if present in those images, otherwise zero-length
Study Time	(0008,0030)	2	SCP: Used, SCU: Duplicated from patient model images if present in those images, otherwise zero-length
Referring Physician's Name	(0008,0090)	2	SCP: Used, SCU: Duplicated from patient model images if present in those images, otherwise zero-length

Attribute Name	Tag	Type	Attribute Description
Referring Physician Identification Sequence	(0008,0096)	3	SCP: Not used, SCU: Not generated
>Include 'Person Identification Macro'			
Study ID	(0020,0010)	2	SCP: Required. SCU: Duplicated from patient model images (must be present in those images - see 3.4.2.1)
Accession Number	(0008,0050)	2	SCP: Used, SCU: Duplicated from patient model images if present in those images, otherwise zero-length
Study Description	(0008,1030)	3	SCP: Used, SCU: If IHE compatibility option set then duplicated from patient model images, otherwise not generated.
Physician(s) of Record	(0008,1048)	3	SCP: Not used, SCU: Not generated
Physician(s) of Record Identification Sequence	(0008,1049)	3	SCP: Not used, SCU: Not generated
>Include 'Person Identification Macro'			
Name of Physician(s) Reading Study	(0008,1060)	3	SCP: Not used, SCU: Not generated
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	SCP: Not used, SCU: Not generated
>Include 'Person Identification Macro'			
Referenced Study Sequence	(0008,1110)	3	SCP: Not used, SCU: Not generated
>Include 'SOP Instance Reference Macro'			
Procedure Code Sequence	(0008,1032)	3	SCP: Not used, SCU: Not generated
>Include 'Code Sequence Macro'			

8.4.3 Series Entity Modules

8.4.3.1 RT Series

TABLE 8-49: RT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SCU: 'RTSTRUCT' SCP: Must be 'RTSTRUCT' (DICOM requirement)
Series Instance UID	(0020,000E)	1	SCU: New generated if the saved RT Plan/RTSS pair is not a modification of an existing RT Plan/RTSS pair, otherwise the same Series Instance UID kept as the RTSS was using. SCP: Used.
Series Number	(0020,0011)	2	SCU: Generated: '103' SCP: Used for display if non-null
Series Description	(0008,103E)	3	SCU: Generated: 'AdvantageSim RT Structure Sets' SCP: Used for display if provided
Operator's Name	(0008,1070)	2	SCU: Name of the operator defined at the last plan save SCP: Not used
Referenced Performed Procedure Step Sequence	(0008,1111)	3	SCU: Not generated SCP: Not used

Attribute Name	Tag	Type	Attribute Description
>Include 'SOP Instance Reference Macro'			
Request Attributes Sequence	(0040,0275)	3	SCU: Not generated SCP: Not used
>Include 'Request Attributes Macro'			
Include 'Performed Procedure Step Summary Macro'			SCU: Not generated SCP: Not used

8.4.3.2 General Equipment Module

TABLE 8-50: GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	SCU: 'GE MEDICAL SYSTEMS' SCP: Used to determine system creating object and for display, if non-null (recommended for clear identification of creating system)
Institution Name	(0008,0080)	3	SCU: Not generated, SCP: Not used
Institution Address	(0008,0081)	3	SCU: Not generated, SCP: Not used
Station Name	(0008,1010)	3	SCU: <station hostname>, SCP: Not used
Institutional Department Name	(0008,1040)	3	SCU: Not generated, SCP: Not used
Manufacturer's Model Name	(0008,1090)	3	SCU: 'AdvantageSim', SCP: Used to determine system creating object and for display, if provided (recommended for clear identification of creating system)
Device Serial Number	(0018,1000)	3	SCU: <station host ID>, SCP: Not used
Software Versions	(0018,1020)	3	SCU: 8.<subversion>.<build>' (single-valued), SCP: Used to determine system creating object and for display, if provided (recommended for clear identification of creating system)
Gantry ID	(0018,1008)	3	SCU: Not generated, SCP: Not used
Spatial Resolution	(0018,1050)	3	SCU: Not generated, SCP: Not used
Date of Last Calibration	(0018,1200)	3	SCU: Not generated, SCP: Not used
Time of Last Calibration	(0018,1201)	3	SCU: Not generated, SCP: Not used
Pixel Padding Value	(0028,0120)	1C	SCU: Not generated, SCP: Not used

8.4.4 Structure Set Entity Modules

8.4.4.1 Structure Set

TABLE 8-51: STRUCTURE SET MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Structure Set Label	(3006,0002)	1	SCU: Equal to comment entered when saving AdvantageSim Plan, truncated to 16 characters SCP: Used for display and object identification
Structure Set Name	(3006,0004)	3	SCU: Equal to comment entered when saving AdvantageSim Plan (non-truncated) SCP: Used for display and object identification

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	3	SCU: Always provided by AdvantageSim SCP: Used for display if provided
Structure Set Date	(3006,0008)	2	SCU: Date at moment object was saved SCP: Used for display if non-null
Structure Set Time	(3006,0009)	2	SCU: Time at moment object was saved SCP: Used for display if non-null
Couch Removal St (GE private attribute)	(0249,xxE0)	3	SCU: GE private attribute storing whether or not scanner couch has been removed by the AdvantageSim software. Enumerated values: PRESENT, REMOVED. SCP: Used for automatic removal of treatment couch, if present. Not required by AdvantageSim (if absent, user will be asked if treatment couch is to be removed).
View Layout (GE private attribute)	(0249,xxE1)	3	SCU: GE private attribute of 4 or 8 values specifying view types of upper left, upper right, lower left, and lower right AdvantageSim views (in that order). Defined terms: "EMPTY", "3D", "AXIAL", "SAGITTAL", "CORONAL", "OBLIQUE", "PROFILE", "CURVED". SCP: Used to initialize view layout. Not required by AdvantageSim (if absent, default AdvantageSim view layout will be used).
Planar View Windowing (GE private attribute)	(0249,xxE2)	3	SCU: GE private attribute (W, L) specifying window width (centered on window level) and window level in Hounsfield Units for planar AdvantageSim views. SCP: Used to set initial W/L after loading RT Structure Set. Not required by AdvantageSim (if absent, default AdvantageSim W/L will be used).
Remove Couch coordinates of the 'plane'	(0249,xxE6)	3	SCU: GE private attribute storing the coordinates of the plane used for couch removal on the Axial view. SCP: Used to remove the treatment couch when loading RT Structure Set. Not required by AdvantageSim (if absent a warning will be displayed to remove the couch manually).
Referenced Frame of Reference Sequence	(3006,0010)	3	SCU: Sequence may contain one or more items, corresponding to the frame of reference of the modality images (CT, MR and PET) SCP: MUST CONTAIN ONE OR MORE ITEMS, EXACTLY ONE OF EACH WHICH MUST BE REFERENCED BY ALL ROIS
>Frame of Reference UID	(0020,0052)	1C	SCU: Duplicated from patient model images if present in those images, otherwise a unique UID will be created by AdvantageSim SCP: FOR THE ITEM REFERENCED BY ROIS, MUST CORRESPOND TO FRAME OF REFERENCE UID (0020,0052) OF ACQUISITION IMAGES
>RT Referenced Study Sequence	(3006,0012)	3	SCU: Sequence can contain one or more items, corresponding to the Studies containing the loaded modality images (CT/MR/PET). SCP: MUST CONTAIN ONE OR MORE ITEMS, EXACTLY ONE OF EACH WHICH MUST BE REFERENCED BY ROIS
>>Referenced SOP Class UID	(0008,1150)	1C	SCU: Always provided SCP: Not used

Attribute Name	Tag	Type	Attribute Description
>>Referenced SOP Instance UID	(0008,1155)	1C	SCU: Always provided SCP: Not used
>>RT Referenced Series Sequence	(3006,0014)	1C	SCU: Sequence can contain one or more items, corresponding to the Series containing the loaded modality images (CT/MR/PET) SCP: FOR THE ITEM REFERENCED BY ROIS, MUST CORRESPOND TO CT IMAGE SERIES. AdvantageSim will load all the referenced series from the RT Structure Set.
>>>Series Instance UID	(0020,000E)	1C	SCU: Always provided SCP: Not used
>>>3D Model Name	(0249,xxE5)	3	SCU: Stores the unique name assigned for each series of images loaded in AdvantageSim MD. SCP: Used by AdvantageSim to assign unique names for the loaded series and to identify the series loaded together in a 4D sequence. Unique model name will be generated if it is absent. (Ex. CT1_1, CT1_2, … , CT1_n)
>>>Contour Image Sequence	(3006,0016)	1C	SCU: Sequence will contain all images used for building the corresponding patient model, even if some images, or all have no corresponding contour. SCP: For the RT Referenced Series Sequence item referenced by ROIs, all images will be used to construct the 3D model used as reference, even if they do not contain a contour. All the RT Referenced Series Sequence items will be loaded into AdvantageSim, if they comply with other rules. AT LEAST FIVE IMAGE ITEMS MUST BE PROVIDED. SPACING BETWEEN IMAGES IS STRONGLY RECOMMENDED TO BE LESS THAN 10 MM FOR ADEQUATE 3D MODEL RECONSTRUCTION
>>>>Referenced SOP Class UID	(0008,1150)	1C	SCU: Always equal to CT, MR or PET Image SOP Class SCP: Must be equal to CT, MR or PET Image SOP Class
>>>>Referenced SOP Instance UID	(0008,1155)	1C	SCU: Always provided SCP: Required by AdvantageSim to locate referenced images in AW database. AdvantageSim ME release can identify the referenced images based on the SOP Instance UID only within the same patient.
Structure Set ROI Sequence	(3006,0020)	3	SCU: Always provided unless there have been no structures defined in AdvantageSim, in which case the sequence will be absent. There is no practical limit of the number of items in AdvantageSim MD. SCP: There is no practical limit to the number of items in AdvantageSim. This sequence may also be absent (no structures/markers defined).
>ROI Number	(3006,0022)	1	SCU: AdvantageSim will number structures in increasing numeric order, starting from 1, as they are found in the plan SCP: Used to uniquely identify ROI when referenced by ROI Contour and RT ROI Observations Modules (DICOM requirement). Used to uniquely identify AdvantageSim structures and markers if ROI Name is invalid or not supplied
>Referenced Frame of Reference UID	(3006,0024)	1	SCU: Equal to Frame of Reference UID (0020,0052) above SCP: MUST BE EQUAL TO EXACTLY ONE FRAME OF

Attribute Name	Tag	Type	Attribute Description
			REFERENCE UID (0020,0052) IN REFERENCED FRAME OF REFERENCE SEQUENCE (3006,0010). ALL ROIS MUST REFERENCE THE SAME FRAME OF REFERENCE
>ROI Name	(3006,0026)	2	SCU: Equal to AdvantageSim structure name SCP: Used for AdvantageSim structure or marker name if a valid non-duplicate name, otherwise ROI Number is used to uniquely identify ROI in AdvantageSim
>ROI Generation Algorithm	(3006,0036)	2	SCU: Provided the corresponding structure creation method (MANUAL, SEMIAUTOMATIC and AUTOMATIC) if interoperability option is set otherwise let it empty SCP: Not used
>ROI Generation Thresholds (GE private attribute)	(0249,xxE3)	3	SCU: GE private attribute (Hl,Hu) representing lower and upper Hounsfield Number thresholds used for automatic contouring of this structure. Attribute will be absent if structure was not contoured automatically. SCP: Used to set default structure contouring thresholds for this structure. Not required by AdvantageSim (if absent, default thresholds will be used).
>ROI Bridge Removal Pixels (GE private attribute)	(0249,xxE4)	3	SCU: GE private attribute representing size in pixels of bridges to be removed during automatic contouring. Attribute will be absent if structure was not contoured automatically. Value of zero indicates remove bridges option was not used. SCP: Used to set default structure remove bridges value for this structure. Not required by AdvantageSim (if absent, no bridge removal will be assumed).
Autosegmentation description	(0249,xxE8)	3	SCU: GE private attribute representing the description about the auto-segmentation.

8.4.4.2 ROI Contour Module

TABLE 8-52: ROI CONTOUR MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
ROI Contour Sequence	(3006,0039)	1	SCU: Sequence will always contain all the structures defined in the Structure Set Module, in the same sequential order. Sequence will also contain all general and beam markers as POINT Contour Geometric Type (3006,0042) and MARKER RT ROI Interpreted Type (3006,00A4). The sequence will be saved empty if no structures, general markers and beam markers defined. Even if the sequence is empty, the RTSS is used to track the referenced images for the RT Plan. Saving the empty sequence is an intended non-conformance to the DICOM standard. SCP: Multiple contours on slices (bifurcation or multi-part structures), and slices without contours are permitted. Each item corresponds to an ROI defined in the Structure Set ROI Sequence (3006, 0020). The ROI Contour Sequence (3006, 0039) can be zero-length if no structure or general marker or beam marker defined for the corresponding plan.
>Referenced ROI Number	(3006,0084)	1	SCU: Always provided SCP: Must correspond to exactly one ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) (DICOM requirement)
>ROI Display Color	(3006,002A)	3	SCU: Contains RGB values corresponding to color used for displaying contour in AdvantageSim application SCP: If RGB values correspond to AdvantageSim color, AdvantageSim color is used otherwise, “nearest” AdvantageSim color is used.
>Contour Sequence	(3006,0040)	3	SCU: Provided if ROI has contours, which have been defined by AdvantageSim, otherwise sequence will not be transmitted SCP: Sequence may be absent if no contours have been defined
>>Contour Number	(3006,0048)	3	SCU: Not used. SCP: Not used.
>>Attached Contours	(3006,0049)	3	SCU: Not used. SCP: Not used.
>>Contour Image Sequence	(3006,0016)	3	SCU: Sequence will always contain exactly one item (referenced CT image) SCP: Sequence can contain one or more items. Contours without a Contour Image Sequence (3006,0016) (i.e. not attached to an acquisition slice) are not used by AdvantageSim.
>>>Referenced SOP Class UID	(0008,1150)	1	SCU: Always provided SCP: Not used
>>>Referenced SOP Instance UID	(0008,1155)	1	SCU: Always provided SCP: Used to locate acquisition image in order to verify consistency of contour z coordinates.

Attribute Name	Tag	Type	Attribute Description
>>Contour Geometric Type	(3006,0042)	1	SCU: 'CLOSED_PLANAR' for structures, 'POINT' for markers SCP: STRUCTURES WITH CONTOURS OTHER THAN 'CLOSED_PLANAR' AND MARKERS OTHER THAN 'POINT' WILL NOT BE USED BY AdvantageSim
>>Contour Slab Thickness	(3006,0044)	3	SCU: For structures, equal to the sum of the zplus and zminus half thickness in AdvantageSim. Not provided for markers SCP: Not used (slab thickness calculated from acquisition slice)
>>Number of Contour Points	(3006,0046)	1	SCU: In AdvantageSim there is no limit imposed on the number of points in a contour shape SCP: 'CLOSED_PLANAR' CONTOURS MUST HAVE THREE OR MORE POINTS
>>Contour Data	(3006,0050)	1	SCU: Z coordinate of contour data is the Z coordinate of referenced slices. Coordinates are in DICOM coordinate system, not Voxtool RAS coordinate system. Marker positions in AdvantageSim are not restricted to lie on acquisition slices, and therefore their Z coordinate may take any value. SCP: Contour is projected onto voxel plane of AdvantageSim 3D model, which is closest to the Contour Data Z coordinates. THESE Z COORDINATES MUST LIE WITHIN THE SLICE THICKNESS OF THE ACQUISITION SLICE REFERENCED IN THE CONTOUR IMAGE SEQUENCE (3006,0016)

8.4.4.3 RT ROI Observations

TABLE 8-53: RT ROI OBSERVATIONS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
RT ROI Observations Sequence	(3006,0080)	1	SCU: Sequence can have zero or more items and contains all the structures and markers defined in the Structure Set Module, in the same sequential order. There is no limit to the number of items only to the number of structures. The sequence will be saved empty if no structures, general markers and beam markers defined. Even if the sequence is empty, the RTSS is used to track the referenced images for the RTPlan. Saving the empty sequence is an intended non-conformance to the DICOM standard. SCP: Each item corresponds to an ROI defined in the Structure Set ROI Sequence (3006,0020). If none of the structures in the RT Structure Set have defined contours, then RT ROI Observations Sequence (3006,0080) is zero-length
>Observation Number	(3006,0082)	1	SCU: AdvantageSim will number observations in increasing numeric order, starting from 1 (i.e. Observation Number will correspond to ROI Number) SCP: Not used
>Referenced ROI Number	(3006,0084)	1	SCU: Always provided

Attribute Name	Tag	Type	Attribute Description
			SCP: Must correspond to exactly one ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) (DICOM requirement)
>ROI Observation Label	(3006,0085)	3	SCU: Equal to AdvantageSim structure name, truncated to 16 characters SCP: Not used
>RT ROI Interpreted Type	(3006,00A4)	2	SCU: Supported types are EXTERNAL, PTV, CTV, GTV, AVOIDANCE, ORGAN, CONTRAST_AGENT, CAVITY, and MARKER. Will be zero-length if Structure Type is UNKNOWN in AdvantageSim SCP: ROIs with an Interpreted Type of ISOCENTER will be converted to MARKER. ROIs with an Interpreted Type other than ISOCENTER or those in the above list will be converted to UNKNOWN
>ROI Interpreter	(3006, 00A6)	2	SCU: Zero-length SCP: Not used

8.4.4.4 SOP Common Module

TABLE 8-54
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SCU: '1.2.840.10008.5.1.4.1.1.481.3' SCP: Must be equal to '1.2.840.10008.5.1.4.1.1.481.3' (DICOM requirement)
SOP Instance UID	(0008,0018)	1	SCU: UID root will be '1.2.840.113619.6.196' SCP: Used to verify association with RT Plans
Specific Character Set	(0008,0005)	1C	SCU: 'ISO_IR 100' SCP: Specific Character Sets other than 'ISO_IR 100' are not handled explicitly by AdvantageSim
Instance Creation Date	(0008,0012)	3	SCU: Same as Structure Set Date (3006,0008) SCP: Not used
Instance Creation Time	(0008,0013)	3	SCU: Same as Structure Set Time (3006,0009) SCP: Not used
Instance Creator UID	(0008,0014)	3	SCU: '1.2.840.113619.6.196' SCP: If Instance Creator UID corresponds to a version of AdvantageSim, then it is used to prevent loading of old-format RT Structure Sets, otherwise not used
Related General SOP Class UID	(0008,001A)	3	SCU: Not generated, SCP: Not used
Original Specialized SOP Class UID	(0008,001B)	3	SCU: Not generated, SCP: Not used
Coding Scheme Identification Sequence	(0008,0110)	3	SCU: Not generated, SCP: Not used
>Coding Scheme Designator	(0008,0102)	1	
>Coding Scheme Registry	(0008,0112)	1C	
>Coding Scheme UID	(0008,010C)	1C	
>Coding Scheme External ID	(0008,0114)	2C	

Attribute Name	Tag	Type	Attribute Description
>Coding Scheme Name	(0008,0115)	3	
>Coding Scheme Version	(0008,0103)	3	
>Coding Scheme Responsible Organization	(0008,0116)	3	
Timezone Offset From UTC	(0008,0201)	3	SCU: Not generated, SCP: Not used
Contributing Equipment Sequence	(0018,A001)	3	SCU: Not generated, SCP: Not used
>Purpose of Reference Code Sequence	(0040,A170)	1	
>>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	1	
>Institution Name	(0008,0080)	3	
>Institution Address	(0008,0081)	3	
>Station Name	(0008,1010)	3	
>Institutional Department Name	(0008,1040)	3	
>Manufacturer's Model Name	(0008,1090)	3	
>Device Serial Number	(0018,1000)	3	
>Software Versions	(0018,1020)	3	
>Spatial Resolution	(0018,1050)	3	
>Date of Last Calibration	(0018,1200)	3	
>Time of Last Calibration	(0018,1201)	3	
>Contribution DateTime	(0018,A002)	3	
>Contribution Description	(0018,A003)	3	
Instance Number	(0020,0013)	3	See Structure Set Module
SOP Instance Status	(0100,0410)	3	SCU: Not generated, SCP: Not used
SOP Authorization Date and Time	(0100,0420)	3	SCU: Not generated, SCP: Not used
SOP Authorization Comment	(0100,0424)	3	SCU: Not generated, SCP: Not used
Authorization Equipment Certification Number	(0100,0426)	3	SCU: Not generated, SCP: Not used
MAC Parameters Sequence	(4FFE,0001)	3	SCU: Not generated, SCP: Not used
>MAC ID Number	(0400,0005)	1	
>MAC Calculation Transfer Syntax UID	(0400,0010)	1	
>MAC Algorithm	(0400,0015)	1	
>Data Elements Signed	(0400,0020)	1	
Digital Signatures Sequence	(FFFA,FFFA)	3	SCU: Not generated, SCP: Not used
>MAC ID Number	(0400,0005)	1	
>Digital Signature UID	(0400,0100)	1	
>Digital Signature DateTime	(0400,0105)	1	
>Certificate Type	(0400,0110)	1	
>Certificate of Signer	(0400,0115)	1	
>Signature	(0400,0120)	1	
>Certified Timestamp Type	(0400,0305)	1C	
>Certified Timestamp	(0400,0310)	3	

Attribute Name	Tag	Type	Attribute Description
>Digital Signature Purpose Code Sequence	(0400,0401)	3	
>>Include 'Code Sequence Macro'			
Encrypted Attributes Sequence	(0400,0500)	1C	SCU: Not generated, SCP: Not used
>Encrypted Content Transfer Syntax UID	(0400,0510)	1	
>Encrypted Content	(0400,0520)	1	
Original Attributes Sequence	(0400,0561)	3	SCU: Not generated, SCP: Not used
>Source of Previous Values	(0400,0564)	2	
>Attribute Modification DateTime	(0400,0562)	1	
>Modifying System	(0400,0563)	1	
>Reason for the Attribute Modification	(0400,0565)	1	
>Modified Attributes Sequence	(0400,0550)	1	
>>Any Attribute from the main data set that was modified or removed; may include Sequence Attributes and their Items.			
HL7 Structured Document Reference Sequence	(0040,A390)	1C	SCU: Not generated, SCP: Not used
>Referenced SOP Class UID	(0008,1150)	1	
>Referenced SOP Instance UID	(0008,1155)	1	
>HL7 Instance Identifier	(0040,E001)	1	
>Retrieve URI	(0040,E010)	3	

8.5 PRIVATE DATA DICTIONARY FOR RT STRUCTURE SET

Private Creator Identification GEMS_RTEN_01

Attribute Name	Tag	VR	VM
Couch Removal Status	(0249,xxE0)	CS	1
View Layout	(0249,xxE1)	CS	4,8
Planar View Windowing	(0249,xxE2)	IS	2
ROI Generation Thresholds	(0249,xxE3)	IS	2
ROI Bridge Removal Pixels	(0249,xxE4)	IS	1
3D Model Name	(0249,xxE5)	CS	1
Remove Couch Coordinate	(0249,xxE6)	CS	1
Autosegmentation description	(0249,xxE8)	LO	1

9 RT PLAN INFORMATION OBJECT IMPLEMENTATION

9.1 INTRODUCTION

This section specifies the use of the DICOM RT Plan IOD to represent the information included in plans produced by this implementation, and also specifies the requirements for the RT Plan IOD when being used as input to AdvantageSim. Corresponding attributes are conveyed using the module construct.

AdvantageSim implements the RT Plan IOD as a Standard Extended object, containing three additional elements defined in the RT General Plan Module (**see Section 9.4.3.1**), one additional element in the RT Patient Setup Module (**see Section 9.4.3.2**), and eight additional elements in the RT Beams module (**see Section 9.4.3.3**).

These twelve attributes are:

- In the RT General Plan Module:
- Macro List (0249,xxF1), storing lists of presets and macros used in the AdvantageSim application;
- Print Preferences (0249,xxF3), storing the default settings for the AdvantageSim print function;
- Treatment Device Conventions (0249,xxF4), storing the conventions (IEC-1217 or machine-based) used when displaying beam angles and collimator jaws.
- In the RT Patient Setup Module:
- Patient Scanned Position (0249,xxF2), storing a copy of the Patient Position (0018,5100) in the acquisition images.

In the RT Beams Module:

- Referenced Machine SOP Class UID (0249,xxC0), and Referenced Machine SOP Instance UID (0249,xxC1) of the GE Private DICOM Treatment Machine object used for the beam;
- Group Name (0249,xx51) and Group Properties (0249,xx52), properties of the AdvantageSim beam group;
- Associated Markers (0249,xxCA), the list of RT Structure Set markers, which are related to the current beam;
- Beam Limiting Device Mode (0249,xxF5), the operating mode of the collimator for the current beam.
- DRR Settings (0249,xxF6), the current DRR settings for the current beam;
- Conformation Algorithm (0249,xxF7), the conformation algorithm used for the current beam.

These attributes are provided for enhanced functionality when reading RT Plans created by the AdvantageSim application itself. They should be ignored by SCP implementations interpreting these objects. These attributes are not required in RT Plans created by SCU implementations for use in AdvantageSim.

9.2 RT PLAN IOD IMPLEMENTATION

This section defines the implementation of the RT Plan information object in the AdvantageSim application. It refers to the DICOM Standard Part 3 (Information Object Definitions).

In the following tables, notes are provided for when AdvantageSim is acting as a producer of objects (SCU), and a consumer of objects (SCP). Notes in UPPER CASE LETTERS represent restrictions on object contents imposed by AdvantageSim when acting as an SCP (object consumer).

9.2.1 AdvantageSim Mapping of DICOM entities

DICOM entities map to the AdvantageSim entities in the following manner:

DICOM	AdvantageSim
Patient Entity	Patient Entity
Study Entity	Examination Entity
Series Entity	Series Entity
Equipment Entity	Workstation on which AdvantageSim application is running
Plan Entity	AdvantageSim geometric information related to defined beams

9.3 RT PLAN IOD MODULE TABLE

Within an entity of the DICOM RT Plan Information Object Definition, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 9-55 RT PLAN IOD MODULE TABLE identifies the defined modules within the entities, which comprise the DICOM RT Plan Information Object Definition. Modules are identified by Module Name.

See DICOM Standard Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 9-55: RT PLAN IOD MODULE TABLE

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	See 8.4.1
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	See 8.4.2
	Patient Study	Not used	N/A
	Clinical Trial Study	Not used	N/A
Series	RT Series	Used	See 9.4.1.1
	Clinical Trial Series	Not used	N/A
Equipment	General Equipment	Used	See 8.4.3.2
Frame Of Reference	Frame Of Reference	Used	See 9.4.2
Plan	RT General Plan	Used	See 9.4.3.1
	RT Prescription	Not used	N/A
	RT Tolerance Tables	Not used	N/A
	RT Patient Setup	Used	See 9.4.3.2
	RT Fraction Scheme	Not used	N/A
	RT Beams	Used	See 9.4.3.3
	RT Brachy Application	Not used	N/A
	Approval	Used	See 9.4.3.4
	SOP Common	Used	See 9.4.3.5

9.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the RT Plan Information Object.

Note: The elements that are not listed in tables will not be present in generated images.

9.4.1 Series Entity Modules

9.4.1.1 RT Series

TABLE 9-56: RT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SCU: 'RTPLAN' SCP: Must be 'RTPLAN' (DICOM requirement)
Series Instance UID	(0020,000E)	1	SCU: New generated if the saved RT Plan/RTSS pair is not a modification of an existing RT Plan/RTSS pair, otherwise the same Series Instance UID kept as the RT Plan was using. SCP: Used
Series Number	(0020,0011)	2	SCU: Generated: '105' SCP: Used for display if non-null
Series Description	(0008,103E)	3	SCU: Generated: 'AdvantageSim RT Plans' SCP: Used for display if provided
Operator's Name	(0008,1070)	2	SCU: Name of the operator defined at last plan save. SCP: Used for display if not empty.
Referenced Performed Procedure Step Sequence	(0008,1111)	3	SCU: Not generated SCP: Not used
>Include 'SOP Instance Reference Macro'			
Request Attributes Sequence	(0040,0275)	3	SCU: Not generated SCP: Not used
>Include 'Request Attributes Macro'			
Include 'Performed Procedure Step Summary Macro'			SCU: Not generated SCP: Not used

9.4.2 Frame Of Reference Module

This module is sent only if interoperability option is set.

TABLE 9-57: FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Of Reference UID	(0020,0052)	1	SCU: Provided the frame of reference UID of reference series only if interoperability option set SCP: Not used
Position Reference Indicator	(0020,1040)	2	SCU: Provided as empty only if interoperability option set SCP: Not Used

9.4.3 Plan Entity Modules

9.4.3.1 RT General Plan Module

TABLE 9-58: RT GENERAL PLAN MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
RT Plan Label	(300A,0002)	1	SCU: Equal to comment entered when saving AdvantageSim Plan, truncated to 16 characters SCP: Used for display and object identification
RT Plan Name	(300A,0003)	3	SCU: Equal to comment entered when saving AdvantageSim Plan (non-truncated) SCP: Used for display and object identification
Instance Number	(0020,0013)	3	SCU: Always provided by AdvantageSim SCP: Used for display if provided
RT Plan Date	(300A,0006)	2	SCU: Date at moment object was saved SCP: Used for display if non-null
RT Plan Time	(300A,0007)	2	SCU: Time at moment object was saved SCP: Used for display if non-null
RT Plan Geometry	(300A,000C)	1	SCU: 'PATIENT' SCP: if it is 'PATIENT' AdvantageSim will load the RT Plan with the referenced RTSS and series.If it is 'TREATMENT DEVICE', then the RT Structure Set object must be loaded first, then the RT Plan object from Utilities/Load Plan.
Referenced Structure Set Sequence	(300C,0060)	1C	SCU: Sequence will always contain exactly one item, referencing RT Structure Set saved at same time as Plan SCP: When RT Plan Geometry is 'PATIENT' AdvantageSim requires an RT Structure Set based on CT data. Not used when RT Plan Geometry is 'TREATMENT DEVICE' (Ex. Helax and ADAC RT Plan)
>Referenced SOP Class UID	(0008,1150)	1C	SCU: '1.2.840.10008.5.1.4.1.1.481.3' (RT Structure Set) SCP: Must be '1.2.840.10008.5.1.4.1.1.481.3' (RT Structure Set)
>Referenced SOP Instance UID	(0008,1155)	1C	SCU: References RT Structure Set instance associated with current plan. In AdvantageSim RT Structure Set and RT Plan instances are always saved as a pair (even when there are no beams defined) SCP: Must be specified referenced RT Structure set upon RT Plan based on
DRR Preset List (GE private attribute)	(0249,xxF0)	3	SCU: Not used SCP: Not used.
Macro List (GE private attribute)	(0249,xxF1)	3	SCU: GE private attribute storing list of macros that will be available in the AdvantageSim application. SCP: Not required by AdvantageSim. If present, used to initialize macro list. Should not be provided by non-GE implementations.
Print Preferences (GE private attribute)	(0249,xxF3)	3	SCU: GE private attribute storing preferences (defaults) when printing from the AdvantageSim application. SCP: Not required by AdvantageSim. If present, used to

Attribute Name	Tag	Type	Attribute Description
			initialize printing function. Should not be provided by non-GE implementations.
Treatment Device Conventions (GE private attribute)	(0249,xxF4)	3	SCU: GE private attribute storing default treatment angle and collimator conventions when plan is loaded into AdvantageSim. Enumerated values: [Frame7] SCP: Not required by AdvantageSim. If present, used to initialize default treatment conventions.

9.4.3.2 RT Patient Setup Module

TABLE 9-59: RT PATIENT SETUP MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Setup Sequence	(300A,0180)	1	SCU: Sequence will always contain exactly one item SCP: Sequence may contain one or more items. ALL BEAMS IN BEAM SEQUENCE (300A,00B0) MUST REFERENCE THE SAME PATIENT SETUP NUMBER (300A,0182).
>Patient Setup Number	(300A,0182)	1	SCU: 1 SCP: Used to uniquely identify Patient Setup referenced by beams.
>Patient Position	(0018,5100)	1C	SCU: Patient treatment position in AdvantageSim application. May be different from patient orientation in CT images used to build patient model when patient has been scanned 'FFS' or 'FFP'. In these cases, patient may be 'flipped' to 'HFS' and 'HFP' respectively for simulation, if operator selects this option. SCP: NON-NULL VALUE REQUIRED. PATIENT POSITION MUST BE THE SAME AS PATIENT POSITION DEFINED IN CT IMAGES, EXCEPT THAT 'HFS' IS ALSO PERMITTED FOR 'FFS' CT IMAGES, AND 'HFP' IS PERMITTED FOR 'FFP' CT IMAGES. IF CT IMAGE PATIENT POSITION IS NOT DEFINED (DEFAULTS TO 'HFS'), PATIENT POSITION MUST BE 'HFS' HERE.
>Patient Setup Technique	(300A,01B0)	3	SCU: Provided the user selected setup technique only if interoperability option is set. One of the following enumeration may be included: ISOCENTRIC FIXED_SSD TBI BREAST_BRIDGE SKIN_APPOSITION SCP: not used
>Patient Scanned Position (GE private attribute)	(0249, xxF2)	3	SCU: GE private attribute specifying position in which patient was scanned. Strictly equal to value of attribute Patient Position (0018, 5100) in referenced acquisition images. Provided to allow applications reading RT Plan only to correctly transform patient into room coordinate system. SCP: Not required by AdvantageSim. If present, verified as being same as value of Patient Position (0018, 5100)

Attribute Name	Tag	Type	Attribute Description
			in referenced acquisition images.

9.4.3.3 RT Beams Module

TABLE 9-60: RT BEAMS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Beam Sequence	(300A,00B0)	1	SCU: Always provided unless no beams have been defined in AdvantageSim, in which case the entire module will be absent SCP: Sequence may be absent, in which case only Patient Setup information will be used
>Beam Number	(300A,00C0)	1	SCU: AdvantageSim will number beams in increasing numeric order, starting from 1, as they are found in the Plan SCP: Used to uniquely identify beams if Beam Name is invalid or not supplied.
>Beam Name	(300A,00C2)	3	SCU: Equal to AdvantageSim beam name SCP: Used for AdvantageSim Beam Name if provided and valid. IF PROVIDED, BEAM NAME (300A,00C2) MUST BE UNIQUE WITHIN BEAM SEQUENCE (300A,00B0). If not provided, Beam Number (300A,00C0) is used to uniquely identify Beam in AdvantageSim.
>Beam Type	(300A,00C4)	1	SCU: 'STATIC' SCP: MUST BE 'STATIC'
>Radiation Type	(300A,00C6)	2	SCU: Zero-length if not defined for current beam, otherwise 'PHOTON' or 'ELECTRON' SCP: MUST BE EITHER ZERO-LENGTH (NO MODALITY DEFINED), 'PHOTON' OR 'ELECTRON'. BLOCKS MUST NOT BE DEFINED FOR BEAMS WITH ZERO-LENGTH RADIATION TYPE.
>Treatment Machine Name	(300A,00B2)	2	SCU: Name of machine associated with beam in AdvantageSim. If treatment machine has not been defined in AdvantageSim for one or more beams, it will not be possible to save the plan. SCP: Used to find treatment machine in AdvantageSim machine database, if GE private attributes Referenced Machine SOP Class UID (0249,xxC0) and Referenced Machine SOP Instance UID (0249,xxC1) are not defined. AdvantageSim uses treatment machine with the same name (converted to lowercase) and the highest-numbered machine suffix. IF ADVANTAGESIM TREATMENT MACHINE DOES NOT EXIST, RT PLAN WILL BE REJECTED.
>Referenced Machine SOP Class UID (GE private attribute)	(0249,xxC0)	3	SCU: GE private attribute storing private (GE) SOP Class of treatment machine used to define current beam. Equal to '1.2.840.113619.4.5.251'. SCP: Used for uniquely determining AdvantageSim treatment machine associated with current beam. If this attribute is absent, Treatment Machine Name is used for this purpose.
>Referenced Machine SOP Instance	(0249,xxC1)	3	SCU: GE private attribute storing SOP Instance of

Attribute Name	Tag	Type	Attribute Description
UID (GE private attribute)			treatment machine used to define current beam. SCP: Used for uniquely determining AdvantageSim treatment machine associated with current beam. If this attribute is absent, Treatment Machine Name is used for this purpose.
>Group Name (GE private attribute)	(0249,xx51)	3	SCU: GE private attribute storing name of AdvantageSim beam group containing current beam. SCP: Used for grouping beams if provided, otherwise placed in a default AdvantageSim beam group, having properties of isocenters unlinked and not equal angles.
>Group Properties (GE private attribute)	(0249,xx52)	3	SCU: GE private attribute storing properties of AdvantageSim beam group containing current beam. One or more values can be included. Defined Terms: EQUAL_ANGLES COMM_ISOCENTER SCP: Used for grouping beams if provided, otherwise placed in a default AdvantageSim beam group. IF DEFINED, PROPERTIES MUST BE THE SAME FOR ALL BEAMS IN THE GROUP.
>Associated Markers (GE private attribute)	(0249,xxCA)	3	SCU: GE private attribute storing ROI Names (3006,0026) of markers in the associated RT Structure Set, which have been defined as relating to the current beam. SCP: Used for associating markers with beams if provided, otherwise all markers are defined as normal (non-associated) markers.
>DRR Settings (GE private attribute)	(0249,xxF6)	3	SCU: GE private attribute storing the DRR settings for the current beam. Format: decimal values separated by '\'. Values: 'DRR state'\'Low Density Mix Coef.'\'Soft Tissue Mix Coef.'\'Bones Mix Coef.'\'Custom Mix Coef.'\'Custom Low Threshold'\'Custom High Threshold'\'Depth Control Center'\'Depth Control Width'. SCP: Used for setting the DRR attributes for the current beam if provided, otherwise default settings used.
>Conformation Algorithm (GE private Attribute)	(0249,xxF7)	3	SCU: GE private attribute storing the Conformation Algorithm used for the current beam. Defined Terms: OUTSIDE INSIDE HALF SCP: Used to set the Conformation Algorithm for the current beam if provided, otherwise default (OUTSIDE) is used.
>Source-Axis Distance	(300A,00B4)	3	SCU: Source-axis distance of machine associated with beam in AdvantageSim SCP: MUST BE DEFINED, AND EQUAL TO SOURCE-AXIS DISTANCE SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. The requirement that this attribute be defined has been imposed to provide a check on the coherence of the critical SAD parameter.

Attribute Name	Tag	Type	Attribute Description
>Beam Limiting Device Sequence	(300A,00B6)	1	SCU: Sequence will always contain two or three (add-on MLC) items SCP, NON-MLC COLLIMATORS: SEQUENCE MUST CONTAIN EXACTLY TWO ITEMS. THE COMBINATION OF THE TWO RT BEAM LIMITING DEVICE TYPES (300A,00B8) MUST BE COMPATIBLE WITH THE COLLIMATOR TYPE SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. SCP, MLC COLLIMATORS: AS FOR NON-MLC COLLIMATORS, EXCEPT THAT SEQUENCE MAY CONTAIN TWO OR THREE ITEMS.
>>RT Beam Limiting Device Type	(300A,00B8)	1	SCU: Will be 'X', 'Y', 'ASYMX', 'ASYMY', 'MLCX' or 'MLCY', according to collimator type of machine associated with beam in AdvantageSim SCP: THERE MUST BE TWO ITEMS WHICH REPRESENT MUTUALLY ORTHOGONAL JAWS
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	SCU: Will be between 1 and 200 SCP: MUST EQUAL NUMBER OF LEAF/JAW PAIRS SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE, OR SPECIAL CASE IS ACCEPTED WHEN TYPE IS MLC AND CORRESPONDING TREATMENT MACHINE TYPE IS SYM/ASYM(COMPATIBLE)
>>Leaf Position Boundaries	(300A,00BE)	2C	SCU: Provided only for 'MLCX' and 'MLCY' collimators. AdvantageSim supports collimators with unequal leaf widths. SCP: NON-NULL VALUE REQUIRED FOR MLCX OR MLCY COLLIMATORS. MUST EQUAL LEAF POSITION BOUNDARIES SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE, OR SPECIAL CASE IS ACCEPTED WHEN TYPE IS MLC AND CORRESPONDING TREATMENT MACHINE TYPE IS SYM/ASYM(COMPATIBLE).
>>Beam Limiting Device Mode (GE private attribute)	(0249,xxF5)	3	SCU: GE private attribute storing current "mode" of collimator jaw. Defined terms: SYMMETRIC = Functioning as symmetric jaw pair (in the case of MLC's, all leaves on the same jaw have the same position). ASYMMETRIC = Functioning as asymmetric jaw pair (in the case of MLC's, all leaves on the same jaw have the same position). MLC = Functioning in full multi-leaf mode. SCP: Used for setting initial collimator mode, if present. Not required by AdvantageSim (if absent, default collimator mode will be used).
>Referenced Patient Setup Number	(300C,006A)	3	SCU: 1 (i.e. references only patient setup specified in RT Patient Setup module) SCP: MUST BE DEFINED, and correspond to Patient Setup Number (300A, 0182) in exactly one item of Patient Setup Sequence (300A, 0180). ALL BEAMS IN BEAM SEQUENCE (300A, 00B0) MUST

Attribute Name	Tag	Type	Attribute Description
			REFERENCE THE SAME PATIENT SETUP NUMBER (300A, 0182).
>Treatment Delivery Type	(300A,00CE)	3	SCU: 'TREATMENT' SCP: Not used
>Number of Wedges	(300A,00D0)	1	SCU: Equal to number of Wedges defined for beam in AdvantageSim. SCP: Not used
>Wedge Sequence	(300A,00D1)	1C	SCU: Provided if Number of Wedges (300A,00D0) greater than 0. Number of Wedges (300A,00D0) items will be present in the sequence. SCP: AdvantageSim displays the orientation of the first wedge. No other wedge attributes are used.
>>Wedge Number	(300A,00D2)	1	SCU: Identification number of the wedge SCP: USED TO IDENTIFY THE FIRST WEDGE, WHICH WILL BE DISPLAYED.
>>Wedge Type	(300A,00D3)	2	SCU: Wedge type. Defined Terms: STANDARD DYNAMIC MOTORIZED SCP: Not used
>>Wedge ID	(300A,00D4)	3	SCU: Use supplied identifier for the wedge SCP: Not used
>>Wedge Angle	(300A,00D5)	2	SCU: Nominal wedge angle SCP: Not used
>>Wedge Factor	(300A,00D6)	2	SCU: Nominal wedge factor SCP: Not used
>>Wedge Orientation	(300A,00D8)	2	SCU: Wedge Orientation SCP: Used to diplay the wedge orientation on the DRR view of the current beam
>>Source To Wedge Tray Distance	(300A,00DA)	3	SCU: Radiation source to wedge tray attachement edge distance SCP: Not used
>Number of Compensators	(300A,00E0)	1	SCU: 0 SCP: Compensators are ignored by AdvantageSim
>Number of Boli	(300A,00ED)	1	SCU: 0 SCP: Boli are ignored by AdvantageSim
>Number of Blocks	(300A,00F0)	1	SCU: Equal to number of Blocks or Cutouts defined for beam in AdvantageSim SCP: MUST BE ZERO IF RADIATION TYPE (300A,00C6) IS ZERO-LENGTH
>Block Sequence	(300A,00F4)	1C	SCU: Provided if Number of Blocks greater than 0. Number of Blocks (300A,00F0) items will be sent. SCP: AdvantageSim supports both photon blocks and electron blocks (cutouts)
>>Source to Block Tray Distance	(300A,00F6)	2	SCU: Equal to Source to Block Tray Distance of machine associated with beam in AdvantageSim SCP: NON-NULL VALUE REQUIRED. MUST EQUAL SOURCE TO BLOCK TRAY DISTANCE

Attribute Name	Tag	Type	Attribute Description
			SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE
>>Block Type	(300A,00F8)	1	SCU: 'SHIELDING' or 'APERTURE'. 'APERTURE' blocks or cutouts are represented by specifying the internal edge only (i.e. keyhole blocks are not explicitly modeled). SCP: Block Type is displayed in AdvantageSim using block or cutout color on BEV
>>Block Divergence	(300A,00FA)	2	SCU: Zero-length SCP: Not used
>>Block Number	(300A,00FC)	1	SCU: Blocks will be numbered from 1 to n in order presented in sequence SCP: Used to uniquely identify blocks or cutouts if Block Name is invalid or not supplied
>>Block Name	(300A,00FE)	3	SCU: Equal to block name entered in AdvantageSim SCP: Used for AdvantageSim Block or Cutout Name if provided and valid. IF PROVIDED, BLOCK NAME (300A,00FE) MUST BE UNIQUE WITHIN BLOCK SEQUENCE (300A,00F4). If not provided, Block Number (300A,00FC) is used to uniquely identify block or cutout in AdvantageSim
>>Material ID	(300A,00E1)	2	SCU: Zero-length SCP: Not used
>>Block Thickness	(300A,0100)	2C	SCU: Saved in the plan only if the environment variable AWRT_BLOCKTHICK_SEND is set. SCP: Required if Material ID (300A,00E1) is non-zero length.
>>Block Transmission	(300A,0102)	2C	SCU: Zero-length SCP: Not used.
>>Block Number of Points	(300A,0104)	2	SCU: In AdvantageSim there is no software limit imposed on the number of points in a block shape SCP: NON-NULL VALUE REQUIRED. 3 OR MORE POINTS MUST BE PROVIDED
>>Block Data	(300A,0106)	2	SCU: In AdvantageSim, last data point does not coincide with first beam point (i.e. shape must be closed by connecting first and last point). SCP: NON_NULL VALUE REQUIRED. Last data point is connected to first data point (DICOM specification).
>Final Cumulative Meterset Weight	(300A,010E)	1C	SCU: NOT provided if interoperability option is set otherwise with value 100 SCP: Not used
>Number of Control Points	(300A,0110)	1	SCU: 2 (static beam) SCP: CAN BE MORE THAN 2 CONTROL POINTS.
>Control Point Sequence	(300A,0111)	1	SCU: Sequence will contain exactly two items. First item will contain all relevant beam parameters. Second element will contain only the attribute Cumulative Meterset Weight (300A,0134) 100. SCP: If more than 2 control points are defined in the RT Plan, then AdvantageSim will load only the first control

Attribute Name	Tag	Type	Attribute Description
			point and the remaining control points will be ignored. Second control point item is ignored.
>>Control Point Index	(300A,0112)	1	SCU: 0 for first control point, 1 for second control point SCP: Not used
>>Cumulative Meterset Weight	(300A,0134)	2	SCU: Provided as empty if interoperability option is set otherwise with value 0 for first control point, 100 for second control point SCP: Not used
>>Nominal Beam Energy	(300A,0114)	3	SCU: Provided for first control point only if beam energy defined in AdvantageSim, otherwise attribute not provided SCP: IF PROVIDED FOR FIRST CONTROL POINT, MUST EQUAL NOMINAL BEAM ENERGY SPECIFIED FOR THE CURRENT BEAM PARTICLE TYPE IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. Not used for second control point.
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	SCU: Provided for first control point only. Sequence will contain exactly two items. SCP: FOR FIRST CONTROL POINT, SEQUENCE ITEMS RESTRICTED BY CONDITIONS DESCRIBED IN BEAM LIMITING DEVICE SEQUENCE (300A,00B6) ATTRIBUTE DESCRIPTION (SEE ABOVE). Not used for second control point.
>>>RT Beam Limiting Device Type	(300A,00B8)	1	SCU: Provided for first control point only. Defined terms: X, Y, ASYMX, ASYMY, MLCX, MLCY SCP: For first control point, must correspond to exactly one of Beam Limiting Device Sequence (300A,00B6) items (DICOM requirement). Not used for second control point.
>>>Leaf/Jaw Positions	(300A,011C)	1	SCU: Provided for first control point only SCP: FOR FIRST CONTROL POINT, LEAF/JAW POSITIONS MUST BE WITHIN JAW LIMITS OF CORRESPONDING JAW SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. Not used for second control point.
>>Gantry Angle	(300A,011E)	1C	SCU: Provided for first control point only SCP: FOR FIRST CONTROL POINT, GANTRY ANGLE MUST BE WITHIN GANTRY ANGLE LIMITS SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. Not used for second control point.
>>Gantry Rotation Direction	(300A,011F)	1C	SCU: Provided (value 'NONE') for first control point only SCP: FOR FIRST CONTROL POINT, MUST BE 'NONE'. Not used for second control point.
>>Beam Limiting Device Angle	(300A,0120)	1C	SCU: Provided for first control point only SCP: FOR FIRST CONTROL POINT, BEAM LIMITING DEVICE (COLLIMATOR) ANGLE MUST

Attribute Name	Tag	Type	Attribute Description
			BE WITHIN COLLIMATOR ANGLE LIMITS SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. Not used for second control point.
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	SCU: Provided (value 'NONE') for first control point only SCP: FOR FIRST CONTROL POINT, MUST BE 'NONE'. Not used for second control point.
>>Patient Support Angle	(300A,0122)	1C	SCU: Provided for first control point only SCP: FOR FIRST CONTROL POINT, PATIENT SUPPORT (TABLE) ANGLE MUST BE WITHIN TABLE ANGLE LIMITS SPECIFIED IN CORRESPONDING ADVANTAGESIM TREATMENT MACHINE. Not used for second control point.
>>Patient Support Rotation Direction	(300A,0123)	1C	SCU: Provided (value 'NONE') for first control point only SCP: FOR FIRST CONTROL POINT, MUST BE 'NONE'. Not used for second control point.
>>Table Top Eccentric Angle	(300A,0125)	1C	SCU: Provided (value 0) for first control point only (no eccentric rotation possible in AdvantageSim) SCP: FOR FIRST CONTROL POINT, MUST BE 0. Not used for second control point.
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	SCU: Provided (value 'NONE') for first control point only SCP: FOR FIRST CONTROL POINT, MUST BE 'NONE'. Not used for second control point.
>>Table Top Vertical Position	(300A,0128)	2C	SCU: Provided (zero-length) for first control point only SCP: Not used
>>Table Top Longitudinal Position	(300A,0129)	2C	SCU: Provided (zero-length) for first control point only SCP: Not used
>>Table Top Lateral Position	(300A,012A)	2C	SCU: Provided (zero-length) for first control point only SCP: Not used
>>Isocenter Position	(300A,012C)	2C	SCU: Provided for first control point only SCP: FOR FIRST CONTROL POINT MUST BE PROVIDED. Not used for second control point.
>>Source to Surface Distance	(300A,0130)	3	SCU: Distance from beam origin to first point of patient model encountered along central axis ray. This may not correspond to the true patient surface if the beam passes through the treatment table and the treatment table has not been removed from the patient model. If the central axis ray does not intersect the patient, or intersects through the ends of the patient model, then this attribute will be absent. SCP: AdvantageSim recalculates SSD using isocenter position. If Source to Surface Distance (300A,0130) is provided, and is different from the calculated value, AdvantageSim signals this difference and asks the user if the treatment table needs to be removed from the patient model.

Attribute Name	Tag	Type	Attribute Description

9.4.3.4 Approval Module

This module is sent only if interoperability option is set.

TABLE 9-61: RT APPROVAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Approval Status	(300E,0002)	1	SCU: Provided with value "UNAPPROVED" only if interoperability option set SCP: Not used.

9.4.3.5 SOP Common Module

TABLE 9-62
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SCU: '1.2.840.10008.5.1.4.1.1.481.5' SCP: Must be equal to '1.2.840.10008.5.1.4.1.1.481.5' (DICOM requirement)
SOP Instance UID	(0008,0018)	1	SCU: UID root will be '1.2.840.113619.6.196'
Specific Character Set	(0008,0005)	1C	SCU: 'ISO_IR 100' SCP: Specific Character Sets other than 'ISO_IR 100' are not handled explicitly by AdvantageSim
Instance Creation Date	(0008,0012)	3	SCU: Same as Structure Set Date (3006,0008) SCP: Not used
Instance Creation Time	(0008,0013)	3	SCU: Same as Structure Set Time (3006,0009) SCP: Not used
Instance Creator UID	(0008,0014)	3	SCU: '1.2.840.113619.6.196' SCP: Not used
Related General SOP Class UID	(0008,001A)	3	SCU: Not generated, SCP: Not used
Original Specialized SOP Class UID	(0008,001B)	3	SCU: Not generated, SCP: Not used
Coding Scheme Identification Sequence	(0008,0110)	3	SCU: Not generated, SCP: Not used
>Coding Scheme Designator	(0008,0102)	1	
>Coding Scheme Registry	(0008,0112)	1C	
>Coding Scheme UID	(0008,010C)	1C	
>Coding Scheme External ID	(0008,0114)	2C	
>Coding Scheme Name	(0008,0115)	3	
>Coding Scheme Version	(0008,0103)	3	
>Coding Scheme Responsible Organization	(0008,0116)	3	
Timezone Offset From UTC	(0008,0201)	3	SCU: Not generated, SCP: Not used
Contributing Equipment Sequence	(0018,A001)	3	SCU: Not generated, SCP: Not used
>Purpose of Reference Code	(0040,A170)	1	

Attribute Name	Tag	Type	Attribute Description
Sequence			
>>Include 'Code Sequence Macro'			
>Manufacturer	(0008,0070)	1	
>Institution Name	(0008,0080)	3	
>Institution Address	(0008,0081)	3	
>Station Name	(0008,1010)	3	
>Institutional Department Name	(0008,1040)	3	
>Manufacturer's Model Name	(0008,1090)	3	
>Device Serial Number	(0018,1000)	3	
>Software Versions	(0018,1020)	3	
>Spatial Resolution	(0018,1050)	3	
>Date of Last Calibration	(0018,1200)	3	
>Time of Last Calibration	(0018,1201)	3	
>Contribution DateTime	(0018,A002)	3	
>Contribution Description	(0018,A003)	3	
Instance Number	(0020,0013)	3	See General Plan Module
SOP Instance Status	(0100,0410)	3	SCU: Not generated, SCP: Not used
SOP Authorization Date and Time	(0100,0420)	3	SCU: Not generated, SCP: Not used
SOP Authorization Comment	(0100,0424)	3	SCU: Not generated, SCP: Not used
Authorization Equipment Certification Number	(0100,0426)	3	SCU: Not generated, SCP: Not used
MAC Parameters Sequence	(4FFE,0001)	3	SCU: Not generated, SCP: Not used
>MAC ID Number	(0400,0005)	1	
>MAC Calculation Transfer Syntax UID	(0400,0010)	1	
>MAC Algorithm	(0400,0015)	1	
>Data Elements Signed	(0400,0020)	1	
Digital Signatures Sequence	(FFFA,FFFA)	3	SCU: Not generated, SCP: Not used
>MAC ID Number	(0400,0005)	1	
>Digital Signature UID	(0400,0100)	1	
>Digital Signature DateTime	(0400,0105)	1	
>Certificate Type	(0400,0110)	1	
>Certificate of Signer	(0400,0115)	1	
>Signature	(0400,0120)	1	
>Certified Timestamp Type	(0400,0305)	1C	
>Certified Timestamp	(0400,0310)	3	
>Digital Signature Purpose Code Sequence	(0400,0401)	3	
>>Include 'Code Sequence Macro'			
Encrypted Attributes Sequence	(0400,0500)	1C	SCU: Not generated, SCP: Not used
>Encrypted Content Transfer Syntax UID	(0400,0510)	1	

Attribute Name	Tag	Type	Attribute Description
>Encrypted Content	(0400,0520)	1	
Original Attributes Sequence	(0400,0561)	3	SCU: Not generated, SCP: Not used
>Source of Previous Values	(0400,0564)	2	
>Attribute Modification DateTime	(0400,0562)	1	
>Modifying System	(0400,0563)	1	
>Reason for the Attribute Modification	(0400,0565)	1	
>Modified Attributes Sequence	(0400,0550)	1	
>>Any Attribute from the main data set that was modified or removed; may include Sequence Attributes and their Items.			
HL7 Structured Document Reference Sequence	(0040,A390)	1C	SCU: Not generated, SCP: Not used
>Referenced SOP Class UID	(0008,1150)	1	
>Referenced SOP Instance UID	(0008,1155)	1	
>HL7 Instance Identifier	(0040,E001)	1	
>Retrieve URI	(0040,E010)	3	

9.5 PRIVATE DATA DICTIONARY FOR RT PLAN

Private Creator Identification GEMS_RTEN_01

Attribute Name	Tag	VR	VM
Group Name	(0249,xx51)	SH	1
Group Properties	(0249,xx52)	CS	1-n
Referenced Machine SOP Class UID	(0249,xxC0	UI	1
Referenced Machine SOP Instance UID	(0249,xxC1)	UI	1
Associated Markers	(0249,xxCA)	SH	1-n
DRR Preset List (not used)	(0249,xxF0)	OB	1
Macro List	(0249,xxF1)	OB	1
Patient Scanned Position	(0249,xxF2)	CS	1
Print Preferences	(0249,xxF3)	OB	1
Treatment Device Conventions	(0249,xxF4)	CS	1
Beam Limiting Device Mode	(0249,xxF5)	CS	1
DRR Settings	(0249,xxF6)	DS	1
Conformation Algorithm	(0249,xxF7)	SH	1