Technical Publications

DOC2708586
Revision 1

Remote Recon Application on Edison HealthLink DICOM Conformance Statement

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REVISON HISTORY

REV.	DATE	REASON FOR CHANGE
1	30 May 2022	Initial Release

CONFORMANCE STATEMENT OVERVIEW

This DICOM Conformance Statement captures the DICOM capabilities of the GEHC Remote Recon Application on Edison HealthLink(EHL) identified below. This document applies to the following software release of the product:

Deep Learning Image Reconstruction	v1.1.4
Max Field Of View 2 (MaxFOV 2)	v1.0.5
ASiR-V™	v1.1.3
Smart MAR	v1.1.3

TABLE OF CONTENTS

1. INTRODUCTION 8

1.1 Overview 8

1.2 Overall DICOM Conformance Statement Document Structure 9

1.3 Intended Audience 10

1.4 Scope and Field of Application 11

1.5 Important Remarks 11

1.6 References 12

1.7 Definitions 12

1.8 Symbols and Abbreviations 14

2. CONFORMANCE STATEMENT 16

2.1 Introduction ..... Error! Bookmark not defined.

2.2 Implementation Model ..... Error! Bookmark not defined.

2.3 Support of Extended Character Sets 16

3. CT IMAGE IOD 16

3.1 CT Image IOD 16
3.1.1 CT Image IOD Modules 16
3.1.2 Implementation Specific details 17

3.2 Common Modules 17
3.2.1 Patient Module 17
3.2.2 General Study Module 18
3.2.3 Patient Study Module 19
3.2.4 General Series Module 19
3.2.5 General Equipment Module 20
3.2.6 General Image Module 21
3.2.7 VOI LUT Module 22
3.2.8 SOP Common Module 22
3.2.9 Enhanced Equipment Module 22

3.3 CT Image Modules 22
3.3.1 Image Plane Module 22
3.3.2 Image Pixel Module 23
3.3.3 Contrast Bolus Module 23

3.3.4 CT Image Module 24
3.3.5 Frame of Reference Module 27
3.3.6 Other Attributes 27

4. PRIVATE DATA ELEMENTS 28

4.1 CT Image IOD Private Data Elements Definition 28
4.1.1 Private Creator Identification (GEMS_IDEN_01) 28
4.1.2 Private Creator Identification (GEMS_ACQU_01) 28
4.1.3 Private Creator Identification (GEMS_RELA_01) 29
4.1.4 Private Creator Identification (GEMS_STDY_01) 29
4.1.5 Private Creator Identification (GEMS_IMAG_01) 29
4.1.6 Private Creator Identification (GEMS_0039) 29
4.1.7 Private Creator Identification (GEMS_CT_FLRO_1) 29
4.1.8 Private Creator Identification (GEMS_PARM_01) 29
4.1.9 Private Creator Identification (GEMS_HELIOS_01) 30
4.1.10 Private Creator Identification (GEMS_CT_CARDIAC_001) 31
4.1.11 Private Creator Identification (GEHC_CT_ADVAPP_001) 32

1. INTRODUCTION

Note: Throughout this entire document the term "Remote Recon Apps" refers to the following products:

Deep Learning Image Reconstruction	v1.1.4
Max Field Of View 2 (MaxFOV 2)	v1.0.5
ASiR-V™	v1.1.3
Smart MAR	v1.1.3

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 (Conformance Statement), which specifies the GEHC equipment compliance to the DICOM requirements.

Section 3 (CT Image IOD), which specifies the CT IOD.

Section 4 (Private Data Elements), which specifies the Private data element definition for CT IOD.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

GEHC DICOM Conformance Statements

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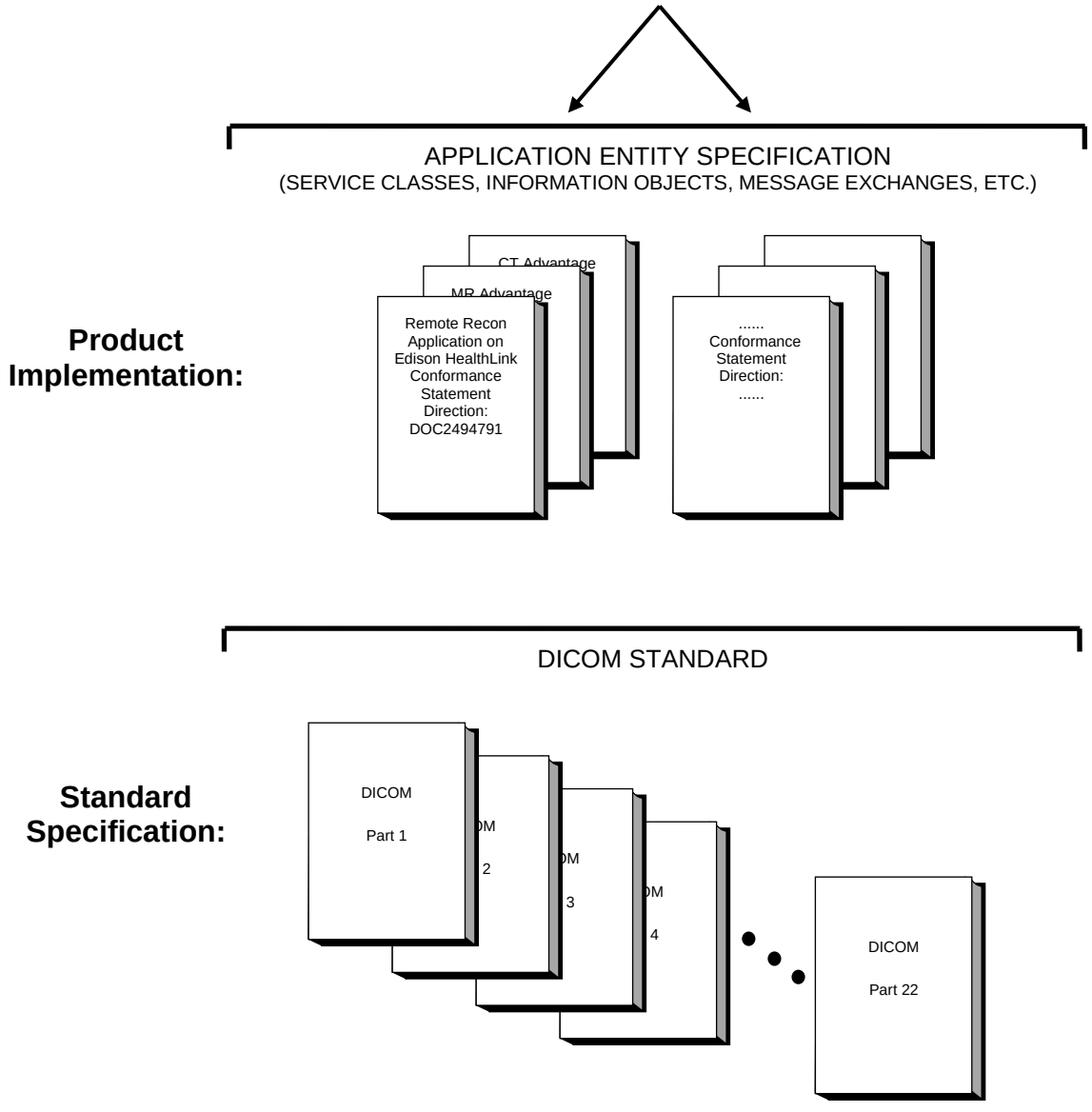
https://www.gehealthcare.com/products/interoperability/dicom



This document specifies the DICOM implementation. It is entitled:

Remote Recon Application on Edison HealthLink
Conformance Statement for DICOM
Direction ***DOC2708586***

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate 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

Note: The Remote Recon Apps on Edison HealthLink are available on GEHC CT products. The DICOM Conformance Statements for Edison HealthLink and GEHC CT products can be found at the following website:

https://www.gehealthcare.com/products/interoperability/dicom

Product	**DICOM Conformance Statement Reference**
GEHC CT - Revolution Ascend	DICOM Conformance Statement for Revolution Ascend Direction # DOC2588240 Rev. 3 or later
GEHC CT - Revolution EVO	DICOM conformance statement for Revolution EVO and Optima CT660 Direction # DOC2253021 Rev.6 or later
GEHC CT – Revolution Frontier	DICOM conformance statement for Discovery CT750 HD/Discovery CT/Revolution HD/Revolution Frontier Direction #DOC2670177 Rev.2 or later
Edison HealthLink	EHL DICOM Conformance Statement Direction # DOC2193822 Rev.3 or later

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. Failure 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 PS3.1 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

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 definitons of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – 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 – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit

VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 SYMBOLS AND ABBREVIATIONS

AE	Application Entity
AET	Application Entity Title
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
PDI	Portable Data for Imaging
PDU	Protocol Data Unit
R	Required (Key Attribute)
RDN	Relative Distinguished Name (LDAP)
RF	Radiofluoroscopy
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
USB	Universal Serial Bus

2. CONFORMANCE STATEMENT

Remote Recon applications on Edison Health Link generates the DICOM CT Images from the rawdata and requests provided by CT system. The generated images are sent back to CT system from Edison Health Link.

The goal of this document is to give a detailed description of the DICOM CT IODs that are generated by the Remote Recon Applications (section 3) and its private data elements(section.4).

2.1 IMPLEMENTATION IDENTIFYING INFORMATION

Remote Recon applications uses same Implementation UID as that of CT system which are connected to the Edison Health Link system. Please refer to the DICOM confirmance statement of CT system (See section 1.2 in this document).

2.2 SUPPORT OF EXTENDED CHARACTER SETS

The Defined Terms for Specific Character Set are defined by following Table:

TABLE 2.2-1
SUPPORTED SPECIFIC CHARACTER SET DEFINED TERMS

Defined Term	Character Set Description
ISO_IR 100	Latin alphabet No. 1
ISO_IR 6	Default repertoire

3. CT IMAGE IOD

The tables below specify the attributes of the CT Image generated by Remote Recon applications.

3.1 CT IMAGE IOD

3.1.1 CT Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	2.2.1	M
Study	General Study	2.2.2	M
	Patient Study	2.2.3	U
Series	General Series	2.2.4	M
Frame of Reference	Frame of Reference	2.3.5	M
Equipment	General Equipment	2.2.5	M

Image	General Image	2.2.6	M
	Image Plane	2.3.1	M
	Image Pixel	2.3.2	M
	Contrast/Bolus	2.3.3	C
	CT Image	2.3.4	M
	Multi-energy CT Image	Not used	NA
	VOI LUT	2.2.7	U
	SOP Common	2.2.8	M

3.1.2 Implementation Specific details

For all CT Images created by GEHC CT patient birth date element (0010,0030) is sent, if the operator has entered the details. If the operator has not entered the details it will be sent as a "Zero length element"

The length of Accession number element (0008,0050) is a maximum of 16 characters

Window Center (0028,1050) and Window Width (0028,1051) are sent for all CT Images created by GEHC CT

Based on whether contrast was used or not the following applies for CT Images created by GEHC CT

Mode	(0018,0010)	(0018,1040)
No Contrast	Not sent	Not sent
Oral Contrast	Oral Contrast Agent name	The string "Oral"
IV Contrast	IV Contrast agent name	The String "IV"
Oral and IV contrast	Oral contrast agent " & " IV Contrast agent	The string "Oral & IV"

Supported field length for DICOM fields

DICOM Tag	Field Name	Field Length
(0008, 0050)	Accession Number	16 characters
(0010, 0010)	Patient Name	64 characters
(0010, 0020)	Patient Id	64 characters

3.2 COMMON MODULES

3.2.1 Patient Module

Attribute Name	Tag	Type	Notes
Patient's Name	(0010,0010)	2	As entered at user interface or from worklist. *Supports 5 different components delimited by "^". Supports a maximum length of 32 characters including the delimiter*. Can be configured to allow

			64 characters.
Patient ID	(0010,0020)	2	As entered at user interface or from worklist. Supports maximum of 16 characters. Can be configured to allow 64 characters.
Patient's Birth Date	(0010,0030)	2	As entered at user interface or from worklist.
Patient's Sex	(0010,0040)	2	As entered at user interface or from worklist.
Referenced Patient Sequence	(0008,1120)	3	From worklist
>Referenced SOP Class UID	(0008,1150)	1	From worklist
>Referenced SOP Instance UID	(0008,1155)	1	From worklist
Other Patient ID	(0010, 1000)	3	From worklist.

3.2.2 General Study Module

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	Value from worklist, if present, is used. Otherwise, the scanner creates a unique value for each exam. If worklist is reused, system can be configured to reuse the study instance uid. Default behavior is to generate a new study instance uid if the worklist is reused.
Study Date	(0008,0020)	2	Generated for each exam and always sent.
Study Time	(0008,0030)	2	Generated for each exam and always sent.
Accession Number	(0008,0050)	2	Value from user interface or worklist sent. If worklists with different accession numbers are grouped, the default behavior is to fill in the top level accession number in the image header. The accession number can be configured to be empty in the grouped case.
Referring Physician's Name	(0008,0090)	2	Value from user interface or worklist sent. Accepts 32 characters by default but is configurable to accept 64 characters.
Study ID	(0020,0010)	2	Generated for each exam on the scanner and always sent..
Study Description	(0008,1030)	3	Value from user interface or worklist sent. Accepts 22 characters by default but is configurable to accept 64 characters.
Name of Physician(s) Reading Study	(0008,1060)	3	Sent if entered at the user interface.
Referenced Study Sequence	(0008,1110)	3	Value from the worklist
>Referenced SOP Class	(0008,1150)	1	Value from the worklist

Attribute Name	Tag	Type	Notes
UID			
>Referenced SOP Instance UID	(0008,1155)	1	Value from the worklist

3.2.3 Patient Study Module

Attribute Name	Tag	Type	Notes
Patient's Age	(0010,1010)	3	Calculated from Date of Birth entered at user interface.
Patient's Size	(0010,1020)	3	Value from user interface or worklist sent
Patient's Weight	(0010,1030)	3	Value from user interface or worklist sent.
Additional Patient's History	(0010,21b0)	3	Value from user interface or worklist sent

3.2.4 General Series Module

Attribute Name	Tag	Type	Notes
Series Number	(0020,0011)	2	Generated sequentially, always sent.
Laterality	(0020,0060)	2C	Always sent zero-length.
Series Date	(0008,0021)	3	Generated for each series and always sent.
Series Time	(0008,0031)	3	Generated for each series and always sent.
Modality	(0008,0060)	1	Always sent as "CT"
Performing Physician's Name	(0008,1050)	3	Mapped from (0040, 0006) in the worklist.
Protocol Name	(0018,1030)	3	Sent if entered at user interface.
Series Description	(0008,103E)	3	Value from user interface is sent.
Operators Name	(0008,1070)	3	Not Sent
Patient Position	(0018,5100)	2C	Sent. As selected by operator when patient is positioned. 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
Series Instance UID	(0020,000E)	1	Always sent
Performed Procedure Step Start Date	(0040,0244)	3	Sent when MPPS option is enabled
Performed Procedure Step Start Time	(0040,0245)	3	Sent when MPPS option is enabled
Performed Procedure Step ID	(0040,0253)	3	Sent when MPPS option is enabled

Performed Procedure Step Description	(0040,0254)	3	Sent when MPPS option is enabled
Requested Attributes Sequence	(0040,0275)	3	Sent when MPPS option is enabled and filled in based on what RIS provides to scanner. Number of items relates to number of items selected from Patient Schedule.
> Requested Procedure ID	(0040,1001)	1C	Always sent, copied from RIS
> Accession Number	(0008,0050)	3	Value from worklist sent
> Referenced Study Sequence	(0008,1110)	3	Value from worklist sent
> Study Instance UID	(0020,000D)	3	Value from worklist sent
> Requested Procedure Desc	(0032,1060)	3	Value from worklist sent
> Requested Procedure Code Sequence	(0032,1064)	3	Value from worklist sent
> Scheduled Procedure Step Desc	(0040,0007)	3	Value from worklist sent
> Scheduled Protocol Code Sequence	(0040,0008)	3	Value from worklist sent
> Scheduled Procedure Step ID	(0040,0009)	1C	Value from worklist sent
> Reason for Requested Procedure	(0040,1002)	3	Not sent.
> Reason for Requested Procedure Code sequence	(0040,100A)	3	Not sent
Body Part Examined	(0018,0015)	3	Only sent for GSI CT images.
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Value used for performed procedure step
>Referenced SOP Class UID	(0008,1150)	1	Value used for performed procedure step
>Referenced SOP Instance UID	(0008,1155)	1	Value used for performed procedure step

3.2.5 General Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	Always sent as “GE MEDICAL SYSTEMS”
Institution Name	(0008,0080)	3	Sent. Value is configurable.
Station Name	(0008,1010)	3	Sent. Value is configurable.
Manufacturers Model Name	(0008,1090)	3	Sent.
Institution Address	(0008,0081)	3	Sent.
Device Serial Number	(0018,1000)	3	Not sent

Attribute Name	Tag	Type	Notes
Software Versions	(0018,1020)	3	Not Sent
Spatial Resolution	(0018,1050)	3	Not Sent
Pixel Padding Value	(0028,0120)	1C	Sent.

3.2.6 General Image Module

Attribute Name	Tag	Type	Notes
Instance Number	(0020,0013)	2	Generated sequentially, always sent.
Patient Orientation	(0020,0020)	2C	Always sent zero length for SC images.
Content Date	(0008,0023)	2C	Generated for each image, always sent.
Content Time	(0008,0033)	2C	Generated for each image, always sent.
Image Type	(0008,0008)	3	Always sent. Value 3: CT Image IOD specific specializations **AXIAL** **LOCALIZER** **SEGMENTED** **REFORMATTED** **PROCESSED** **COMBINED** **CTINTERVENTION** Value 4: GE CT Image implementation specific **MIN IP** **MIP** **AVERAGE** **VOLREN** **INTEGRAL** **HD MIP** **RAYSUM** **SURFACE** **MINMAX** **FLUORO**
Acquisition Number	(0020,0012)	3	Generated for each acquisition, always sent.
Acquisition Date	(0008,0022)	3	Generated for each acquisition, always sent.
Acquisition Time	(0008,0032)	3	Generated for each acquisition, always sent. Format is in fractional seconds as small as 1 millionth of a second.
Referenced Image Sequence	(0008,1140)	3	Generated for specific type image
>Reference SOP Class UID	(0008,1150)	1	Value from scout class UID when Localizer is scanned, and set it to Ax image. Value from EKG Secondary Capture Class UID when

			retrospective recon is selected for cardiac scan.
>Reference SOP Instance UID	(0008,1155)	1	Value from scout instance UID when Localizer is scanned, and set it to Ax image. Value from EKG Secondary Capture instance UID when retrospective recon is selected for cardiac scan.
Irradiation Event UID	(0008,3010)	3	Always sent. Note: This tag gets empty when generate image from scan file of old software version.

3.2.7 VOI LUT Module

Attribute Name	Tag	Type	Notes
Window Center	(0028,1050)	1C	Window Center for display. Always sent.
Window Width	(0028,1051)	1C	Window Width for display. Always sent.

3.2.8 SOP Common Module

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	Always sent.
SOP Instance UID	(0008,0018)	1	Always sent.
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Number	(0020,0013)	3	Always sent.
Instance Creation Date	(0008, 0012)	3	Generated for each image
Instance Creation Time	(0008. 0013)	3	Generated for each image

3.2.9 Enhanced Equipment Module

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	1	Always sent
Manufacturer's Model Name	(0008,1090)	1	Always sent
Device Serial Number	(0018,1000)	1	Sent as empty
Software Version	(0018,1020)	1	Always sent

3.3 CT IMAGE MODULES

3.3.1 Image Plane Module

Attribute Name	Tag	Type	Notes
Slice Thickness	(0018,0050)	2	Value always sent.
Image Slice Location	(0020,1041)	3	Value always sent. Note: Slice Location reflects the

			gantry ISO center table location value for the image in mm. If the gantry is tilted, this value will differ from the image position (0020, 0032) Z value which reflects the upper left-hand voxel (center of the first voxel transmitted) of the grid, in mm in the registered Frame of Reference. The system can be configured to save the upper left-hand corner Z coordinate value into (0020, 1041) Slice Location instead of the gantry ISO center table location.
Image Position	(0020,0032)	1	Always sent. System configuration allows images to be flipped and rotated. Default behavior is to not allow flip and rotate. Note that the Image Position reflects the x, y and z coordinate of the upper left corner of the first voxel transmitted instead of the center of the first voxel transmitted.
Image Orientation	(0020,0037)	1	Always sent. System configuration allows images to be flipped and rotated. Default behavior is to not allow flip and rotate.
Pixel Spacing	(0028,0030)	1	Always sent

3.3.2 Image Pixel Module

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Always sent with value = 1
Photometric Interpretation	(0028,0004)	1	Always sent.
Rows	(0028,0010)	1	Always sent
Columns	(0028,0011)	1	Always sent
Bits Allocated	(0028,0100)	1	Always sent with value = 16
Bits Stored	(0028,0101)	1	Always sent with value = 16
High Bit	(0028,0102)	1	Always sent with value = 15
Pixel Representation	(0028,0103)	1	Always sent with value = 1
Pixel Data	(7FE0,0010)	1	Always sent

3.3.3 Contrast Bolus Module

Attribute Name	Tag	Type	Notes
Contrast/Bolus Agent	(0018,0010)	2	Sent if contrast exam, as entered in user interface.
Contrast/Bolus Route	(0018,1040)	3	Sent if contrast exam, as entered in user interface.
Contrast IV Volume (Only with Revolution Ascend)	(0018,1041)	3	Sent if contrast exam, as entered in user interface.

3.3.4 CT Image Module

Attribute Name	Tag	Type	Notes
Image Type	(0008,0008)	1	Always sent. Defined terms: Value 3: **AXIAL** **LOCALIZER** **SEGMENTED** **REFORMATTED** **PROCESSED** **COMBINED** **CTINTERVENTION** Value 4: **MIN IP** **MIP** **AVERAGE** **VOLREN** **INTEGRAL** **HD MIP** **RAYSUM** **SURFACE** **MINMAX** **FLUORO**
Samples per Pixel	(0028,0002)	1	Always sent with value = 1
Photometric Interpretation	(0028,0004)	1	Always sent
Bits Allocated	(0028,0100)	1	Always sent with value = 16
Bits Stored	(0028,0101)	1	Always sent with value = 16
High Bit	(0028,0102)	1	Always sent with value = 15
Rescale Intercept	(0028,1052)	1	Always sent
Rescale Slope	(0028,1053)	1	Always sent
Rescale Type	(0028,1054)	1C	Always sent with value = HU
KVP	(0018,0060)	2	Value always sent.
Acquisition Number	(0020,0012)	2	Value always sent.
Scan Options	(0018,0022)	3	Value always sent. Defined Terms : **AXIAL MODE** **SCOUT MODE** **AXIAL XRON MODE** **AXIAL XROFF MODE** **STATIC XRON MODE**

Attribute Name	Tag	Type	Notes
			STATIC XROFF MODE **TUBE HEAT MODE** **DAS MODE** **TUBE CAL MODE** **BIOPSY MODE** **CINE** **HELICAL** **ROTGENCAL MODE** **FLUORO MODE**
Data Collection Diameter	(0018,0090)	3	Value always sent.
Reconstruction Diameter	(0018,1100)	3	Value sent for all images except scouts.
Distance Source to Detector	(0018,1110)	3	Value always sent.
Distance Source to Patient	(0018,1111)	3	Value always sent.
Gantry / Detector Tilt	(0018,1120)	3	Value always sent.
Table Height	(0018,1130)	3	Value always sent.
Rotation Direction	(0018,1140)	3	Not sent for scout or axial.
Exposure Time	(0018,1150)	3	Value always sent.
X-Ray Tube Current	(0018,1151)	3	Value always sent.
Exposure	(0018,1152)	3	Value always sent. (See Note below)
Filter Type	(0018,1160)	3	Sent. Defined terms: **BODY FILTER** **MEDIUM FILTER** **HEAD FILTER**
Generator Power	(0018,1170)	3	Always sent
Focal Spot	(0018,1190)	3	Sent. Fixed value of 0.7 or 1.2.
Convolution Kernel	(0018,1210)	3	Not sent for scouts. Defined terms: **SMOOTH** **SOFT** **STANDARD** **STD+** **DETAIL** **BONE** **BONEPLUS** **CHST** **EDGE** **SHARP** **LUNG** **ULTRA**

Attribute Name	Tag	Type	Notes
			HD LUNG **STANDARD2** **DETAIL2** **BONE2** **BONEPLUS2** **EDGE2** **STANDARDPLUS2** **DETAILPLUS2** **HD ULTA** **HD SOFT**
Revolution Time	(0018, 9305)	3	Sent for spiral scan only
Single Collimation Width	(0018, 9306)	3	Sent for spiral scan only
Total Collimation Width	(0018, 9307)	3	Sent for spiral scan only
Table Speed	(0018, 9309)	3	Sent for spiral scan only
Table Feed per Rotation	(0018, 9310)	3	Sent for spiral scan only
Spiral Pitch Factor	(0018, 9311)	3	Sent for spiral scan only

CAUTION

It is possible for the operator of GEHC CT system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.

Note:

Description of how DICOM Exposure field (0018, 1152) is calculated

Helical / Cardiac Helical = Avg_mA_slice * Rotation Time / Pitch

Axial / Cine / Cardiac Axial / Cardiac Cine = Avg_mA_slice * Rotation Time

For SmartmA

Avg_mA_slice = average mA of all views used for back-projection

For Manual mA

If the average mA of all views used for back-projection is within +/- 5% of the prescribed mA, then

Avg_mA_slice = prescribed mA

Otherwise,

Avg_mA_slice = average mA of all views used for back-projection

3.3.5 Frame of Reference Module

Attribute Name	Tag	Type	Notes
Frame of Reference UID	(0020,0052)	1	See Caution below.
Position Reference Indicator	(0020,1040)	2	Value as entered at the user interface.

CAUTION

It is possible for the operator of GEHC CT system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.

3.3.6 Other Attributes

Attribute Name	Tag	Type	Notes
Temporal Position Index (Only with Revolution EVO)	(0020,9128)	3	Filled into CT image for some applications. Pass number for shuttle images.
Nominal Percentage of Cardiac Phase	(0020,9241)	3	Filled into CT image for some applications. Prescribed percentage of cardiac phase.
Creator Version UID	(0008,9123)	3	Not Sent.

4. PRIVATE DATA ELEMENTS

Enclosed is a listing of private data elements used in this implementation for CT Image IOD definition.

4.1 CT IMAGE IOD PRIVATE DATA ELEMENTS DEFINITION

4.1.1 Private Creator Identification (GEMS_IDEN_01)

Attribute Name	Tag	VR	VM
Full fidelity	(0009,1001)	LO	1
Suite id	(0009,1002)	SH	1
Product id	(0009,1004)	SH	1
Image actual date	(0009,1027)	SL	1
Equipment UID	(0009,10E3)	UI	1

Note: For all images created by GEHC CT system (0009,1001) element will have the value “CT_LIGHTSPEED”

4.1.2 Private Creator Identification (GEMS_ACQU_01)

Attribute Name	Tag	VR	VM
Number of cells I in Detector	(0019,1002)	SL	1
Cell number at Theta	(0019,1003)	DS	1
Cell spacing	(0019,1004)	DS	1
Horiz. Frame of ref.	(0019,100F)	DS	1
Series contrast	(0019,1011)	SS	1
First scan ras	(0019,1018)	LO	1
Last scan ras	(0019,101A)	LO	1
Table speed	(0019,1023)	DS	1
Mid scan time	(0019,1024)	DS	1
Mid scan flag	(0019,1025)	SS	1
Degrees of azimuth	(0019,1026)	SL	1
Gantry period	(0019,1027)	DS	1
Number of triggers	(0019,102C)	SL	1
Angle of first view	(0019,102E)	DS	1
Trigger frequency	(0019,102F)	DS	1
Scan FOV type	(0019,1039)	SS	1
Segment number	(0019,1042)	SS	1
Total segments requested	(0019,1043)	SS	1
View compression factor	(0019,1047)	SS	1
Recon post proc. Flag	(0019,1052)	SS	1
Dependent on #views processed	(0019,106A)	SS	1

4.1.3 Private Creator Identification (GEMS_RELA_01)

Attribute Name	Tag	VR	VM
Series from which Prescribed	(0021,1003)	SS	1
Series Prescribed From	(0021,1035)	SS	1
Image Prescribed From	(0021,1036)	SS	1
Biopsy position	(0021,1091)	SS	1
Biopsy T location	(0021,1092)	FL	1
Biopsy ref location	(0021,1093)	FL	1

4.1.4 Private Creator Identification (GEMS_STDY_01)

Attribute Name	Tag	VR	VM
Start time(secs) in first axial	(0023,1070)	FD	1

4.1.5 Private Creator Identification (GEMS_IMAG_01)

Attribute Name	Tag	VR	VM
Scout Type	(0027,1010)	SS	1
Vma mamp	(0027,101C)	SL	1
Vma mod	(0027,101E)	SL	1
GE Noise Index * 10	(0027,101F)	SL	1
Smart scan ON/OFF flag	(0027,1020)	SS	1
Plane Type	(0027,1035)	SS	1
Center R coord of plane image	(0027,1042)	FL	1
Center A coord of plane image	(0027,1043)	FL	1
Center S coord of plane image	(0027,1044)	FL	1
Normal R coord	(0027,1045)	FL	1
Normal A coord	(0027,1046)	FL	1
Normal S coord	(0027,1047)	FL	1
Table start location	(0027,1050)	FL	1
Table end location	(0027,1051)	FL	1

4.1.6 Private Creator Identification (GEMS_0039)

Attribute Name	Tag	VR	VM
SR Application Name	(0039,1095)	LO	1

4.1.7 Private Creator Identification (GEMS_CT_FLRO_1)

Attribute Name	Tag	VR	VM
CT Int Fluoro	(0029,1001)	SS	1
Image Precise Location	(0029,1002)	DS	1

4.1.8 Private Creator Identification (GEMS_PARM_01)

Attribute Name	Tag	VR	VM
Window value	(0043,1010)	US	1

Attribute Name	Tag	VR	VM
X-Ray chain	(0043,1012)	SS	3
Number of overranges	(0043,1016)	SS	1
Delta start time	(0043,101E)	DS	1
Max overranges in a view	(0043,101F)	SL	1
Corrected after glow terms	(0043,1021)	SS	1
Reference channels	(0043,1025)	SS	6
No views ref chans blocked	(0043,1026)	US	4
Scan pitch ratio	(0043,1027)	SH	1
Unique image iden	(0043,1028)	OB	1
Private Scan Options	(0043,102B)	SS	4
RA cord of target recon center	(0043,1031)	DS	2
Trigger on position	(0043,1040)	FL	1
Degree of rotation	(0043,1041)	FL	1
DAS trigger source	(0043,1042)	SL	1
DAS fpa gain	(0043,1043)	SL	1
DAS output source	(0043,1044)	SL	1
DAS ad input	(0043,1045)	SL	1
DAS cal mode	(0043,1046)	SL	1
Start scan to X-Ray on delay	(0043,104D)	FL	1
Duration of X-Ray on	(0043,104E)	FL	1
Recon filter	(0043, 1064)	CS	1

4.1.9 Private Creator Identification (GEMS_HELIOS_01)

Attribute Name	Tag	VR	VM
Number of Macro Rows in Detector	(0045, 1001)	SS	1
Macro width at ISO Center	(0045, 1002)	FL	1
DAS type	(0045, 1003)	SS	1
DAS gain	(0045, 1004)	SS	1
Table Direction	(0045, 1006)	CS	1
Z smoothing Factor	(0045, 1007)	FL	1
View Weighting Mode	(0045, 1008)	SS	1
Sigma Row number	(0045, 1009)	SS	1
Minimum DAS value	(0045, 100A)	FL	1
Maximum Offset Value	(0045, 100B)	FL	1
Number of Views shifted	(0045, 100C)	SS	1
Z tracking Flag	(0045, 100D)	SS	1
Mean Z error	(0045, 100E)	FL	1
Z tracking Error	(0045, 100F)	FL	1
Start View 2A	(0045, 1010)	SS	1
Number of Views 2A	(0045, 1011)	SS	1
Start View 1A	(0045, 1012)	SS	1
Sigma Mode	(0045, 1013)	SS	1
Number of Views 1A	(0045, 1014)	SS	1
Start View 2B	(0045, 1015)	SS	1
Number Views 2B	(0045, 1016)	SS	1
Start View 1B	(0045, 1017)	SS	1
Number of Views 1B	(0045, 1018)	SS	1

Attribute Name	Tag	VR	VM
Iterbone Flag	(0045, 1021)	SS	1
Perisstaltic Flag	(0045, 1022)	SS	1
CardiacReconAlgorithm	(0045, 1030)	CS	1
AvgHeartRateForImage	(0045, 1031)	CS	1
TemporalResolution	(0045, 1032)	FL	1
PctRpeakDelay	(0045, 1033)	CS	1
ActualPctRpeakDelay	(0045, 1034)	CS	1
EkgFullMaStartPhase	(0045, 1036)	CS	1
EkgFullMaEndPhase	(0045, 1037)	CS	1
EkgModulationMaxMa	(0045, 1038)	CS	1
EkgModulationMinMa	(0045, 1039)	CS	1
NoiseReductionImageFilterDesc	(0045, 103B)	LO	1
PrescribedMsPrescription	(0045, 103F)	IS	1
ActualMsPhasePrescription	(0045, 1044)	IS	1
CardiacScanOptions	(0045, 1045)	ST	1
Temporal Center View Angle	(0045, 1050)	FD	1
Recon Center View Angle	(0045, 1051)	FD	1
WideCone Masking	(0045, 1052)	CS	1
WideCone Corner Blending Radius	(0045, 1053)	FD	1
WideCone Corner Blending Radius Offset	(0045, 1054)	FD	1
Internal Recon Algorithm	(0045, 1055)	CS	1
ClinicalIdentifierStep	(0045, 1056)	LO	1
PatientCentering	(0045, 1060)	FL	1-n
PatientAttenuation	(0045, 1061)	FL	1
WaterEquivalentDiameter	(0045, 1062)	FL	1
ProjectionMeasure	(0045, 1063)	FL	1
OvalRatio	(0045, 1064)	FL	1-n
EllipseOrientation	(0045, 1065)	FL	1

Note: Dicom elements (0045, 1030-1034) and (0045, 1036-1039) and (0045, 103B) are present only if the appropriate cardiac option is installed on the scanner.

4.1.10 Private Creator Identification (GEMS_CT_CARDIAC_001)

Attribute Name	Tag	VR	VM
CT Cardiac Sequence	(0049, 1001)	SQ	1
>HeartRateAtConfirm	(0049, 1002)	CS	1
>AvgHeartRatePriorToConfirm	(0049, 1003)	FL	1
>MinHeartRatePriorToConfirm	(0049, 1004)	CS	1
>MaxHeartRatePriorToConfirm	(0049, 1005)	CS	1
>StdDevHeartRatePriorToConfirm	(0049, 1006)	FL	1
>NumHeartRateSamplesPriorToConfirm	(0049, 1007)	US	1
>AutoHeartRateDetectPredict	(0049, 1008)	CS	1
>SystemOptimizedHeartRate	(0049, 1009)	CS	1
>EkgMonitorType	(0049, 100A)	ST	1
>NumReconSectors	(0049, 100B)	CS	1
RpeakTimeStamps	(0049, 100C)	FL	1-256
EkgGatingType	(0049, 1016)	SH	1
EkgWaveTimeOffFirstDataPoint	(0049, 101B)	FL	1
TemporalAlg	(0049, 1022)	CS	1

PhaseLocation	(0049, 1023)	CS	1
PreBlendedCycle1	(0049, 1024)	OW	1
PreBlendedCycle2	(0049, 1025)	OW	1
CompressionAlg	(0049, 1026)	CS	1

Note: Private Group 49 is present only if the appropriate cardiac option is installed on the scanner.

4.1.11 Private Creator Identification (GEHC_CT_ADVAPP_001)

Attribute Name	Tag	VR	VM
ShuttleFlag (Only with Revolution EVO)	(0053, 1020)	IS	1
TableSpeedNotReachesTargetFlag (Only with Revolution EVO)	(0053, 1021)	IS	1
ReconAnnotation	(0053, 1040)	SH	1
ReconMode	(0053, 1041)	SH	1
ReconConfiguration	(0053, 1042)	LO	1
ReconLevel	(0053, 1043)	SH	1
reconFlipRotateAnno	(0053, 1060)	SH	1
HiResMode	(0053, 1061)	SH	1
RespiratoryFlag	(0053, 1062)	SH	1
Image Position Patient Setting	(0053, 1063)	CS	1
Shutter Mode	(0053, 1064)	IS	1
Shutter Mode Percent	(0053, 1065)	IS	1
Image Browser Annotation	(0053, 1066)	LO	1
Overlapped Recon Flag	(0053, 1067)	IS	1
Row Number Anotation Flag	(0053, 1068)	IS	1
ImageCheckAnnotation	(0053, 1069)	LO	1
ODMFlag	(0053, 106A)	IS	1
ODMReductionPercent	(0053, 106B)	IS	1
ASiR Auto Guidance Dose Reduction Percent (Only with Revolution EVO)	(0053, 106F)	IS	1
MultiEnergySourceCount	(0053, 1070)	IS	1
MultiEnergyScanType	(0053, 1071)	LO	1
MultiEnergyReconType	(0053, 1072)	LO	1
MultiEnergyImageType	(0053, 1073)	LO	1
MultiEnergyMaterialType	(0053, 1074)	LO	1
MonochromaticEnergy	(0053, 1075)	DS	1
MultiEnergyAcqMethod	(0053, 1079)	LO	1
MultiEnergyFeatAnnotName	(0053, 107A)	SH	1
MultiEnergyNoiseReduced	(0053, 107B)	SH	1
MultiEnergyNoiseReducdeMethod	(0053, 107C)	LO	1
SubOptimalIQString	(0053, 107D)	LO	1
MultiEnergyHighLowRatio	(0053, 107E)	DS	1
MeasuredEffectiveMeanmA	(0053, 1083)	DS	1
CommandedFirstkVp	(0053, 1084)	DS	1
CommandedFirstmA	(0053, 1085)	DS	1
CommandedSecondkVp	(0053, 1086)	DS	1
CommandedSecondmA	(0053, 1087)	DS	1

MultiEnergyKVAnnotName	(0053, 1088)	SH	1
MultiEnergyKVUnitLabel	(0053, 1089)	SH	1
MaterialType1	(0053, 108A)	LO	1
MaterialType2	(0053, 108B)	LO	1
GSIScanModePreset	(0053, 108C)	LO	1
MonoWindowLow	(0053, 108D)	IS	1-n
MonoWindowHigh	(0053, 108E)	IS	1-n
MD1AttenuationCurve	(0053, 108F)	FL	1-n
MD1intercept	(0053, 1092)	DS	1
MD1slope	(0053, 1093)	DS	1
MD1supportData	(0053, 1095)	OW	1
MD2supportData	(0053, 1096)	OW	1
NM1supportData	(0053, 1097)	OW	1
MD2intercept	(0053, 1098)	DS	1
MD2slope	(0053, 1099)	DS	1
NM2supportData	(0053, 109A)	OW	1
MD2attenuationCurve	(0053, 109B)	FL	1-n
GSIdataVersion	(0053, 109C)	SH	1
MarsAnnotation	(0053, 109D)	LO	1
MultiEnergyNumNoiseRedPairs	(0053, 109E)	IS	1
MultiEnergyNoiseRedString	(0053, 109F)	LO	1-n
PerfusionAnnotation	(0053, 10AA)	LO	1
EnhancedContrastAnnotation (Only with Revolution Ascend)	(0053, 10AB)	LO	1
ZFilterMode	(0053, 10AC)	LO	1

Note: Private tags (0053, 1001) through (0053,1014) and (0053,1070) through (0053,109F) are only present for multi-energy CT images.