



Technical Publications

**Direction 5561505-1EN (DOC1584284)
Revision 3**

***DaTQUANT Standalone Data Manager* DICOM CONFORMANCE STATEMENT**

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LIST OF REVISIONS

REV	DATE	DESCRIPTION	PAGES
1	May 2015	Initial Release	All
2	December 2017	New Release of DatQUANT Application	CONFORMANCE STATEMENT OVERVIEW 2.1 2.8
3	December 2019	Update list of supported Transfer Syntaxes	2.3.1.2.1.2 2.3.1.3.1.2

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CONFORMANCE STATEMENT OVERVIEW

The DaTQUANT Standalone Data Manager (DaTQUANT SA) DICOM implementation allows user to query and retrieve images stored in a remote DICOM station for primary or follow up processing by DaTQUANT Application™ (see the "NM Applications DICOM Conformance Statement" in **Reference A** Section 1.6)

The DaTQUANT SA allows the user to send images and reports, created by DaTQUANT Application™ functionality, or received from any other DICOM compliant system, to another DICOM station.

The DaTQUANT SA DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the DaTQUANT SA DICOM Server.

Table 0.1 provides an overview of the network services supported by DaTQUANT Standalone Data Manager.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
CT Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
PT Image Storage	Yes	Yes
Enhanced SR SOP Class	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model - FIND	Yes	Yes
Study Root Query/Retrieve Information Model - MOVE	Yes	Yes

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1. INTRODUCTION

1.1 OVERVIEW

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

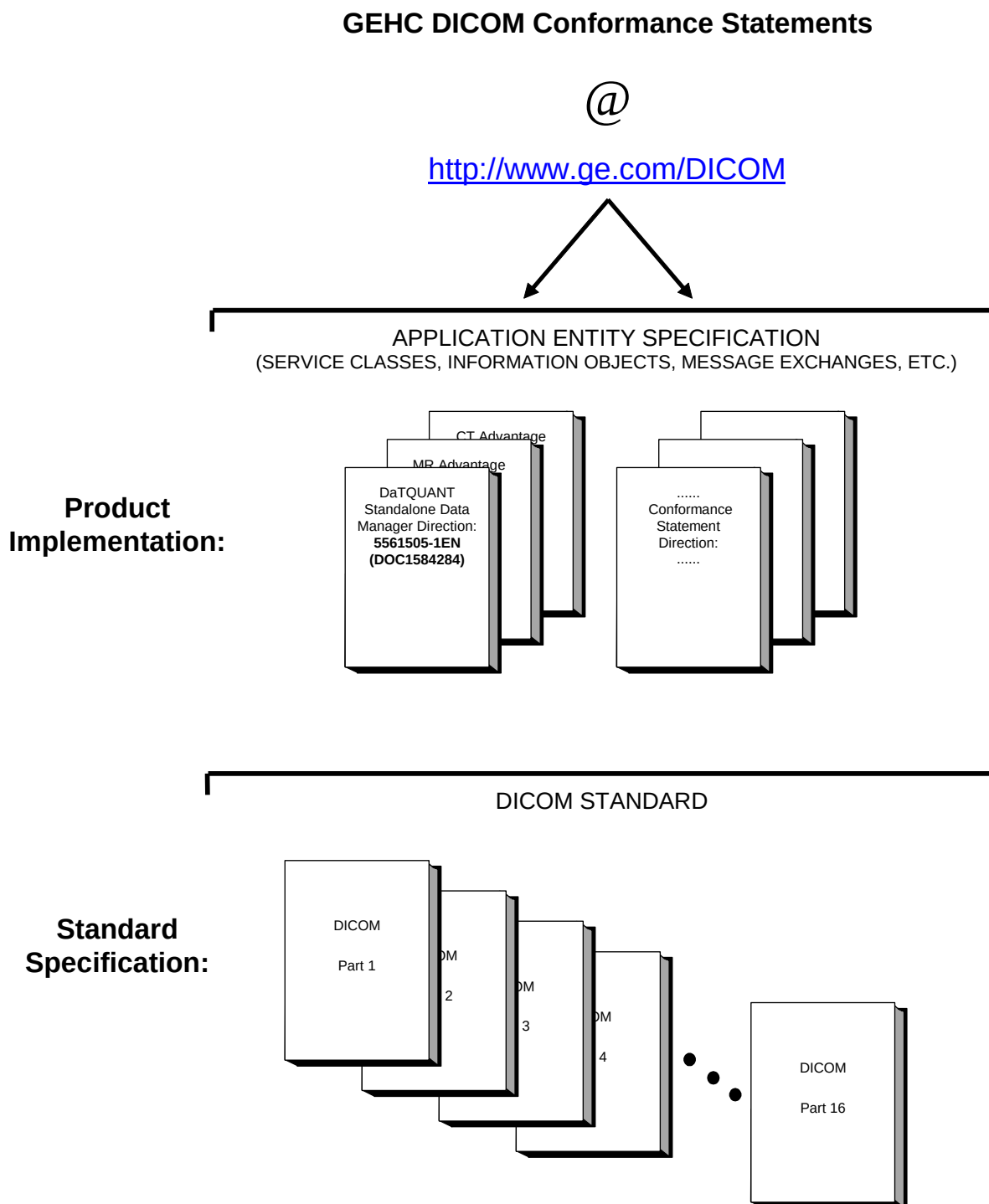
Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

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

Section 3 (QUERY Implementation), which specifies the GEHC equipment compliance to DICOM requirements for the implementation of the Study Root Query/Retrieve service.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM implementation. It is entitled:

DaTQUANT Standalone Data Manager
Conformance Statement for DICOM
Direction 5561505-EN1 (DOC1584284)

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

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** Digital Imaging and Communications in Medicine (DICOM) Standard, available free at <http://medical.nema.org/>
- Reference A** 5503462-1EN (DOC1473333) Rev. 2 “NM Applications DICOM Conformance Statement”

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 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
CT	Computed Tomography
DHCP	Dynamic Host Configuration Protocol

DICOM	Digital Imaging and Communications in Medicine
DNS	Domain Name System
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standards
LUT	Look-up Table
MFSC	Multi-Frame Secondary Capture
NM	Nuclear Medicine
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
R	Required (Key Attribute)
RIS	Radiology Information System
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SDO	Series Data Object
SOP	Service-Object Pair
SR	Structured Reporting
TCP/IP	Transmission Control Protocol/Internet Protocol
U	Unique (Key Attribute)
UL	Upper Layer
VR	Value Representation

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

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

In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, DaTQUANT SA system will provide support for DICOM 3.0.

This section details the roles and DICOM Service Classes supported by the DaTQUANT SA. The DaTQUANT SA DICOM implementation allows user to query and retrieve images stored in a remote DICOM station for primary or follow up processing by DaTQUANT Application™. In this situation DaTQUANT SA provides the DICOM C-FIND and C-MOVE as service class user (SCU) and the DICOM C-STORE service as a service class provider (SCP).

The DaTQUANT SA allows the user to send images and reports, created by DaTQUANT Application™ or received from any other DICOM compliant system, to another DICOM station. In this situation DaTQUANT SA provides the DICOM C-STORE service as a service class user (SCU).

The DaTQUANT SA DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the DaTQUANT SA DICOM Server. In these situation, DaTQUANT SA provides the DICOM C-ECHO service a SCP.

Note: For detailed specification of Images produced by DaTQUANT Application™ refer to "NM Applications DICOM Conformance Statement" in **Reference A** Section 1.6).

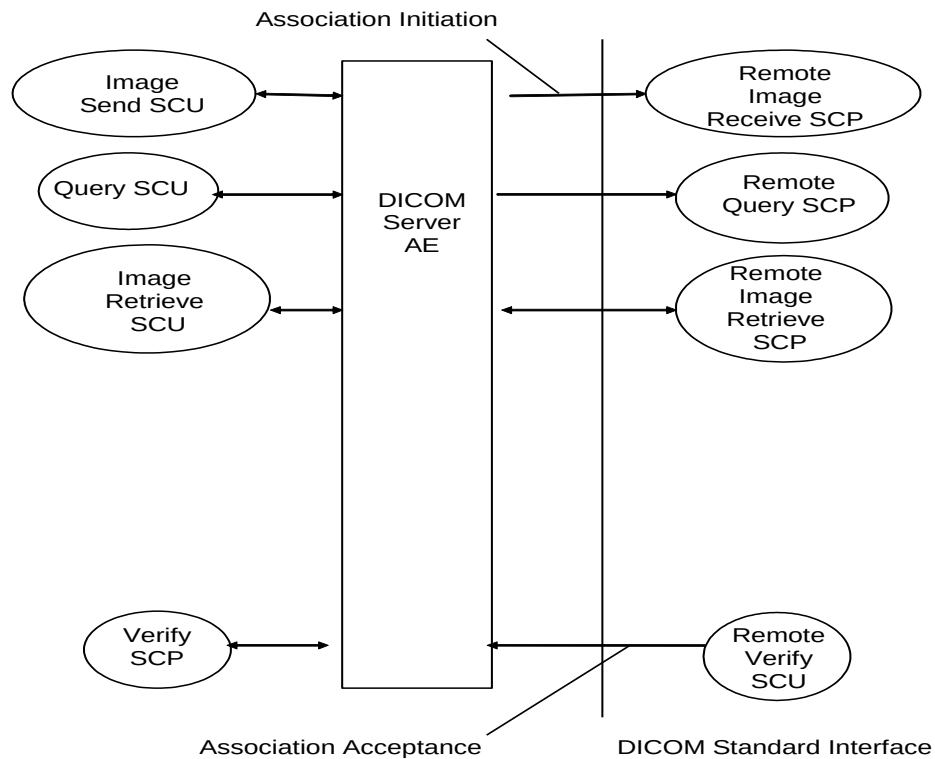
2.2 IMPLEMENTATION MODEL

2.2.1 Application Data Flow Diagram

All DICOM functionality on the DaTQUANT SA product is logically provided by the DICOM Server AE. The DICOM Server AE is commanded to perform DICOM services through the use of the DaTQUANT SA user interface. The DICOM Server AE also listens on a pre-defined port for incoming connections from remote DICOM AEs.

The network application model for the DaTQUANT SA is shown in the following Illustration :

ILLUSTRATION 2-1
DATQUANT SA NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM



2.2.2 Functional Definition of AE's

The DaTQUANT SA DICOM Server Application Entity (AE) initiates the following functions:

- *Store*: Initiates a DICOM association in order to send images to a remote AE. If the remote AE accepts presentation context applicable to the image(s) being sent, the DICOM Server will send the images via the C-STORE service.
- *Query*: Initiates a DICOM association in order to query images on a remote AE. If the remote AE accepts a presentation context applicable to the query request(s) being sent, the DICOM Server will receive appropriate query responses via the C-FIND service. DaTQUANT SA does not issue a C-FIND-CANCEL-RQ to terminate initiated query.
- *Retrieve*: Initiates a DICOM association in order to fetch images from a remote AE. If the remote AE accepts a presentation context applicable to the retrieve request(s), the remote AE initiates a DICOM association for C-STORE-RQ to the DICOM Server AE. If this is acceptable to the DICOM Server AE, then, the image(s) is (are) sent to the DICOM Server AE.

The DaTQUANT SA DICOM Server AE responds to the following functions:

- *Store*: Responds to incoming C-STORE -RQ messages by storing the incoming data stream onto the disk.
- *Verify*: Responds to incoming C-ECHO-RQ messages by returning a C-ECHO-RSP message with a status of "success."

2.2.3 Sequencing of Real-World Activities

DaTQUANT SA Application Entity performs query and retrieves images from PACS or another DICOM station; creates derived images using DaTQUANT Application™ processing functionality ; stores images to the remote DICOM station.

2.3 AE SPECIFICATIONS

2.3.1 DICOM Server AE Specification

The DICOM Server 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
Verification SOP Class	1.2.840.10008.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Yes	Yes
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Enhanced SR Storage	1.2.840.10008.5.1.4.1.1.88.22	Yes	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

2.3.1.1 Association Establishment Policies

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The maximum length PDU receive size for the DICOM Server is:

Maximum Length PDU	32768 (Not Configurable)
---------------------------	---------------------------------

2.3.1.1.2 Number of Associations

The DICOM Server will initiate a maximum of 1 simultaneous associations to remote nodes.

The DICOM Server will support a maximum of 1 simultaneous associations initiated by remote nodes.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

DaTQUANT SA Data Manager Implementation UID	1.2.826.0.1.3680043.2.60.0.1
DaTQUANT SA Data Manager Implementation Version Name	jdt260_2

2.3.1.2 Association Initiation Policy

The DICOM Server AE initiates a new association:

- Due to an image send operation being initiated from the DaTQUANT SA user interface.
- Due to image data being Queried from a Remote AE.
- Due to image data being Retrieved from a Remote AE.
-

When the DICOM Server Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities

The DICOM Server proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

2.3.1.2.1 Real-World Activity: Image Send

2.3.1.2.1.1 Associated Real-World Activity

The operator must select elements (study(ies)/ serie(s)/ image(s)) to be transferred from the DaTQUANT SA Data Manager Browser. Once these selections have been made, the operator selects any DICOM station as target to initiate image send job(s) from the remote DICOM stations list or connects to any new DICOM station.

The DICOM Server AE will then initiate an association(s) with the remote AE in order to perform send job. Each image is transferred within single association. Status of Job becomes ACTIVE. The exception to this is that, if image send fails due to network problems, the current association is closed

If all elements selected for transfer of the ACTIVE send job are successfully transferred, job status is changed to COMPLETED.

If transfer of at least one of the selected elements of the ACTIVE job fails, job final status is set to FAILED.

2.3.1.2.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by DICOM Server AE for Activity “Image Send”					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Explicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCU	None

2.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for All Storage SOP Classes

The DICOM Server AE conforms to the SOP's of the Storage Service Class at Level 2 (Full) conformance.

This implementation performs each C-STORE operation over a single associations. There is not any Time-outs defined in DICOM Server for C-STORE operation.

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a status other than Successful, this implementation considers the request of the current images store to be a failure.

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code	Related Fields
Failed	A700	Refused: Out of resources	Final image send job status is set to FAILED.	None
	C000	Error: Cannot understand	Final image send job status is set to FAILED.	None
Success	0000		Final image send job status is set to COMPLETED	None

2.3.1.2.2 Real-World Activity: Query

2.3.1.2.2.1 Associated Real-World Activity

DaTQUANT SA implements the query operation in 3 levels. The first level of query provides query results pertaining to the Patient and Study objects only. The second level of query provides results regarding the series for the given Study. The third level of query provides results regarding the images for the both given Study and Series.

The First Level Query operation is initiated by the selection of DICOM station from the pool of DICOM repositories.

Before First Level Query, the association is opened to check the Remote station DICOM status. If association is accepted, Query operation proceeds.

The operator can define Search Criteria for the First level Query. If operator selects remote DICOM station as Query repository and presses on “Connect” button, “Filter Dialog” is opened. Operator may define search criteria by “Patient Name”, “Patient Id”, “Study ID”, “Study Description”, “Accession Number”, “Study Date” and “Modalities in Study” attributes or any combination of them. The operator must push “OK” button to initiate the Query operation.

The DICOM Server will then initiate an association with remote AE in order to query remote AE for the given search parameters. The results of the Query operation are indicated in the DaTQUANT SA Browser.

The operator may press on the entry of any Study entry in the DaTQUANT SA Browser to initiate Second Level Query Operation. The DICOM Server will then initiate an association with remote AE in order to query remote AE for the given Study UID as search criteria. The results of the Query operation are displayed in the Series Panel of the DaTQUANT SA Browser.

The operator may press on the entry of any Series entry from the Series Panel of the DaTQUANT SA Browser to initiate Third Level Query Operation. The DICOM Server will then initiate an association with remote AE in order to query remote AE for the given Study UID and Series UID as search criteria. The results of the Query operation are displayed in the Image Panel of the DaTQUANT SA Browser.

No additional search criteria rather than “Study UID” and “Series UID” is provided for the Second Level Query and the Third Level Query.

Note that once initiated the Query operation cannot be cancelled by the operator from DaTQUANT SA UI.

DaTQUANT SA makes use of the Study Root Query/Retrieve Model to initiate a Query operation. Details of this model are provided in **Section 3** of this document. Note that for each level of query operation, a single association is established.

2.3.1.2.2.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by DICOM Server AE for Activity Query					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - FIND SOP Class

The DICOM Server includes matching keys in the queries as described in Section 3

This implementation can perform only single C-FIND operation over a single association. There is not any Time-outs defined in DICOM Server for C-FIND operations.

Upon receiving a C-FIND confirmation containing a Successful status, this implementation closes the association.

Upon receiving a C-FIND confirmation containing a Pending status, this implementation will wait for further C - FIND responses from the remote DICOM AE.

Upon receiving a C-FIND confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-FIND confirmation containing a status other than Successful, Pending or Refused, this implementation will consider the current request to be a failure.

Following are the status codes that are more specifically processed when receiving messages from a **Query** SCP equipment :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	A700	Refused: Out of resources	No results are displayed in the DaTQUANT SA Browser
	A900	Error: Identifier does not match SOP Class	No results are displayed in the DaTQUANT SA Browser
	C000	Error: Unable to process	No results are displayed in the DaTQUANT SA Browser
Success	0000	Matching is complete - No final identifier is supplied	Query results are displayed in the DaTQUANT SA Browser
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	No Visible User Output
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or	No Visible User Output

		matching for this Identifier	
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2.3.1.2.3 Real-World Activity: Retrieve

2.3.1.2.3.1 Associated Real-World Activity

The DatQUANT SA User initiates invocation of the Retrieve (Fetch) operation by the selection of one or more search results (Study/Series/Image results) on the Patient Selector UI of the remote DICOM station automatically just after Query operation is finished. This mechanism assumes that the operator has preceded the Fetch with a Query operation.

DICOM Server will then initiate an association with the remote AE in order to retrieve DICOM images from the remote AE for the given Study/Series/Image selection. The status of operation becomes ACTIVE.

DatQUANT SA makes use of the Study Root Query\Retrieve Model to initiate a Retrieve (Fetch) operation. Details of this model are provided in Section 3 of this document.

Note that only single C-MOVE request may be sent within one association established. There is not any Time-outs defined in DICOM Server for C-MOVE operations.

The final status of Retrieve job is stated according to the final status returned by Retrieve SCP.

2.3.1.2.3.2 Proposed Presentation Context Table

Presentation Context Table – Proposed by DICOM Server AE for Activity “Retrieve”					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - MOVE SOP Class

This implementation can perform only single C-MOVE operations over a single association.

Upon receiving a C-MOVE confirmation containing a Successful status, the implementation will close the association.

Upon receiving a C-MOVE confirmation containing a Pending status, this implementation will wait for further C-MOVE responses from the remote DICOM AE.

Upon receiving a C-MOVE confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-MOVE confirmation containing a status other than Successful, Pending or Warning, this implementation will consider the current request to be a failure.

The C-MOVE-RQ will use the AE Title of the selected as destination remote system Application Entity as the Move Destination AE Title

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	C000	Error: Unable to process	Retrieve Job is moved to FAILED state; Failure Reason is displayed in the Job Browser
Warning	B000	Sub-operations Complete - One or more Failures.	No Visible User Output
Success	0000	Sub-operations Complete - No Failure.	Retrieve Job is moved to COMPLETED state
Pending	FF00	Sub-operations are continuing -	No Visible User Output

2.3.1.3 Association Acceptance Policy

Only those remote DICOM AE added to DatQUANT SA DICOM configuration may connect to the DICOM Server AE. The maximum number of associations accepted in parallel is limited to 5.

The DICOM Server AE responds to image store operations initiated by remote AE's as result of Retrieve real-world Activity. Remote AE sends data to DatQUANT SA DICOM server to be stored in the DatQUANT SA database.

Any remote AE can open an association to the DICOM Server AE for the purpose of application level communication verification.

2.3.1.3.1 Real-World Activity Store Images

2.3.1.3.1.1 Associated Real-World Activity

The DICOM Server AE starts to listen for associations from the Remote Retrieve SCP DICOM station when Retrieve service is initiated. No operator action is required to respond to a Store request.

The real-world activity associated with the Store request is to store the image data in the local database and send a C-STORE -RSP message with the status of "success" for each image that can be stored in the local database. A C-STORE-RSP message with the status "failed" is sent for each image that cannot be stored in the local database.

There is not any Time-outs defined in DICOM Server for Image Storage operation.

2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by DICOM Server AE for Activity "Store Images"					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
Secondary Image	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

Capture Storage		JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50		
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian JPEG Lossless RLE Lossless JPEG Baseline	1.2.840.10008.1.2 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.5 1.2.840.10008.1.2.4.50	SCP	None

2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The AE provides Digital Signature Level 3 support of above mentioned SOP Classes, as it provides full fidelity storage of received SOP Instances.

The AE validates that the Attributes of the SOP Instance meet the requirements of the IOD with respect to Value Representation, presence of Type 1 and 2 elements, valid values, and consistency between image attributes and pixel data.

The DICOM Server AE evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for any Real-World Activity.

Successfully received SOP Instances may be accessed via the user interface . SOP Instances are stored until manually deleted by the user.

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Storage** :

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700	Refused: Out of resources	Returned if the DICOM Server runs out of resources (e.g. memory); error logged.	None
	C000	Error: Cannot Understand	Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Store operation failed; error logged.	None
Success	0000			None

2.3.1.3.1.3 Transfer Syntax Selection Policies

Within each Presentation Context, the DICOM Server will select only Implicit VR Little Endian Transfer Syntax.

2.3.1.3.2 Real-World Activity Verify SCP

2.3.1.3.2.1 Associated Real-World Activity

The DICOM Server AE starts to listen for associations when DatQUANT is connected to the remote DICOM station Query/Retrieve purposes. No operator action is required to respond to a Verification request.

The real-world activity associated with the Verification request is to send a C-ECHO-RSP message with a status of “success” to the requesting AE.

There is not any Time-out defined in DICOM Server for Verify SCP operation.

2.3.1.3.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by DICOM Server AE for Activity “Verify SCP”					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.2.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The DICOM Server AE provides standard conformance to the DICOM verification service class.

2.3.1.3.2.3 Presentation Context Acceptance Criterion

The DICOM Server evaluates each Presentation Context independently, and accepts any Presentation Context that matches an Abstract Syntax for Verify SCP Real-World Activity.

2.3.1.3.2.4 Transfer Syntax Selection Policies

Within each Presentation Context, the DICOM Server will select only Implicit VR Little Endian Transfer Syntax.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from either the Windows XP (SP3) Operating System or the Windows Embedded Standard 7 Operating System, depends on Hardware configuration of system where DatQUANT SA is installed.

For DaTQUANT SA implementation installed on Windows XP , the TCP/IP stack is inherited from the Windows XP (SP3) Operating System.

For DaTQUANT SA implementation installed on Windows 7, the TCP/IP stack is inherited from the Windows Embedded Standard 7 Operating System.

2.4.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

2.4.3 Additional Protocols

DaTQUANT SA implementation supports DHCP Protocol

2.4.4 IPv4 and IPv6 Support

DaTQUANT SA implementation supports IPv4 only

2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

2.5.1 Standard Extended / Specialized / Private SOP Classes

2.5.1.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to all supported SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements.

2.5.1.2 Private SOP Class

No Private SOP Class is supported.

2.5.2 Private Transfer Syntaxes

No Private Transfer Syntax is supported.

2.6 CONFIGURATION

The DatQUANT SA system is configured by the user. The DICOM configuration items below are configurable or re-configurable by a user but are not accessible through the DatQUANT SA user interface.

2.6.1 AE Title/Presentation Address Mapping

DatQUANT SA allows the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different subnet (using routing). A router is configurable to ensure communication from one sub-net to another.

This configuration is performed by DaTQUANT SA user.

2.6.2 Configurable Parameters

The following fields are configurable for DICOM Server AE (local):

- Local AE Title (default value is computer hostname)
- Local Listening Port Number (default value is 4242)

Note: PDU length and any time-outs are not configurable for DICOM Server AE. The configuration of IP routers and subnet mask is available on a OS level.

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

2.7 SUPPORT OF EXTENDED CHARACTER SETS

The DaTQUANT SA is configurable with a single single-byte extended character set, either the default ISO_IR 100 (Latin alphabet Number 1 supplementary set), or the alternate ISO_IR 101 (Latin alphabet Number 2 supplementary set).

2.8 CODES AND CONTROLLED TERMINOLOGY

Refer to "NM Applications DICOM Conformance Statement" in **Reference A** Section 1.6

2.9 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. QUERY IMPLEMENTATION

3.1 DATQUANT SA MAPPING OF DICOM ENTITIES

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

TABLE 3-1
MAPPING OF DICOM ENTITIES TO DATQUANT SA ENTITIES

DICOM	DaTQUANT SA Entity
Patient	Patient
Study	Study
Series	Series
Image	Image

3.2 INFORMATION MODEL KEYS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Query/Retrieve Information Model.

3.2.1 Common Query Keys

The query key attributes specified in this section are used at all levels and in all classes of query.

TABLE 3-2
Q/R PATIENT LEVEL COMMON RETRIEVE ATTRIBUTES

Attribute Name	Tag	Type	SCU Use
Specific Character Set	(0008,0005)	-	See 3.2.1.1.1
Query Retrieve Level	(0008,0052)	-	Set to level of query: STUDY SERIES IMAGE
Retrieve AE Title	(0008,0054)	-	Attribute is not requested. Returned value is ignored
Storage Media File-set ID	(0088,0130)	-	Attribute is not requested. Returned value is ignored
Storage Media File-set UID	(0088,0140)	-	Attribute is not requested. Returned value is ignored

3.2.1.1 Q/R Common Attribute Descriptions

3.2.1.1.1 Specific Character Set

As an SCU, the attribute Specific Character Set (0008,0005) is not sent, unless a patient name is sent with a matching key that includes a non-ASCII character; in that case, the default ISO_IR 100 (Latin alphabet Number 1 supplementary set) extended character set identifier will be sent. Only non-ASCII characters that may be entered from the console keyboard, as described in Section 2.7, may be included in the matching key value. Query response

item text attributes, including patient name, that include non-ASCII characters will be displayed as described in Section 2.7.

3.2.2 Study Level – Study Root

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

TABLE 3-3
STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT
QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Study Date	(0008,0020)	R	Matching Key. Range Date matching is available.
Study Time	(0008,0030)	R	Requested.
Accession Number	(0008,0050)	R	Matching key. Single Value or Wildcard Value may be used.
Station Name	(0008,1010)	R	Requested
Patient's Name	(0010,0010)	R	Matching key. Wildcard Value may be used.
Patient ID	(0010,0020)	R	Matching key. Single Value may be used.
Study ID	(0020,0010)	R	Matching key. Single Value or Wildcard Value may be used.
Study Instance UID	(0020,000D)	U	Requested.
Modalities in Study	(0008,0061)	R	Requested
Patient's Birth Date	(0010,0030)	O	Matching Key. Range Date matching is available.
Patient's Birth Time	(0010,0032)	O	Requested
Patient's Sex	(0010,0040)	O	Requested
Number of Study Related Series	(0020,1206)	O	Requested
Number of Study Related Instances	(0020,1208)	O	Requested
Referring Physician's Name	(0008,0090)	O	Matching key. Wildcard Value may be used.
Name of Physician(s) Reading Study	(0008,1060)	O	Matching key. Wildcard Value may be used.
Study Description	(0008,1030)	O	Requested

3.2.3 Series Level

This section defines the keys at the Series Level of the Study Root Query/Retrieve Information Models that are supported by this implementation.

TABLE 3-4
SERIES LEVEL ATTRIBUTES FOR THE
QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Modality	(0008,0060)	R	Requested
Series Number	(0020,0011)	R	Requested
Series Instance UID	(0020,000E)	U	Requested
Series Date	(0008,0021)	O	Requested
Series Time	(0008,0031)	O	Requested
Series Description	(0008,103E)	O	Requested
Number of Series Related Instances	(0020,1209)	O	Requested
Series Type	(0054,1000)	O	Requested

Image Type	(0008,0008)	O	Requested
Manufacturer	(0008,1070)	O	Requested
Series Description	(0008,103E)	O	Requested
Study Instance UID	(0020,000D)	U	Unique key. Single value is used in request.

3.2.4 Image Level

This section defines the keys at the Image Level of the Study Root Query/Retrieve Information Models that are supported by this implementation.

TABLE 3-5
IMAGE LEVEL ATTRIBUTES FOR THE
QUERY/RETRIEVE INFORMATION MODEL

Attribute Name	Tag	Type	SCU Use
Image Number	(0020,0013)	R	Requested
SOP Instance UID	(0008,0018)	U	Requested
Image ID	(0054,0400)	O	Requested
Image Index	(0054,1330)	O	Requested
Image Type	(0008,0008)	O	Attribute is not requested. Returned value is ignored
Rows	(0028,0010)	O	Requested
Columns	(0028,0011)	O	Requested
Number of Frames	(0028,0008)	O	Requested
Completion Flag	(0040,A491)	O	Requested if remote system supports Structure Reports
Verification Flag	(0040,A493)	O	Requested if remote system supports Structure Reports
Verifying Observer Sequence	(0040,A073)	O	Requested if remote system supports Structure Reports
>Verification Date Time	(0040,A030)	O	Requested if Verifying Observer Sequence is requested
>Verifying Observer Name	(0040,A075)	O	Requested if Verifying Observer Sequence is requested
Concept Name Code Sequence	(0040,A043)	O	Requested if remote system supports Structure Reports
>Code Value	(0008,0100)	O	Requested if Concept Name Code Sequence is requested
>Coding Scheme Designator	(0008,0102)	O	Requested if Concept Name Code Sequence is requested
Study Instance UID	(0020,000D)	U	Unique key. Single value is used in request.
Series Instance UID	(0020,000E)	U	Unique key. Single value is used in request.