MR Imaging System

Model AIRIS / AIRIS-II / AIRIS Mate / Aperto / Altaire / AIRIS Elite

DICOM Conformance Statement

HITACHI MEDICAL CORPORATION

Tokyo, Japan

E1E-BM5440-14

Revision History

Revision	Date	Change Description
1	09/01/98	Preliminary
2	08/19/99	Added Window Center and Window Width Fixed Implementation Version Name
3	12/26/00	Added Altaire
4	05/23/01	Added Print Management and Modality Worklist Management features
5	07/16/01	Corrected Implementation Class UID and version name for Modality Worklist feature
6	01/30/02	Added Aperto Updated search keys for Modality Worklist Added Referenced Image Sequence to General Image Module Attributes
7	———	(This is not a published revision.)
8	11/18/03	Corrected Presentation Context Table for Query Request Corrected Return Keys copied to MR Image IOP table for Modality Worklist
9	12/19/03	Added MPPS feature. Added Storage Commitment feature. Added Media Storage feature. Added Security Profiles. Added Secondary Capture Image Storage. Added Presentation LUT in Print Service Removed Patient Root Query/Retrieve Model as SCU Updated Presentation Context table for Verification, Storage, and Query/Retrieve. Updated Search Keys for Study Root Query/Retrieve Model. Moved description about Verification SOP class.
10	05/25/04	Added AIRIS Elite. Removed Aperto and AIRIS Mate. Updated search keys for Modality Worklist. Updated DCserver SOP Class Extension. Updated DICOM Image Transfer and Storage Commitment Configurations.
11	05/12/05	Added Aperto.
12	06/01/05	Modified Aperto to Aperto Series.
13	09/16/05	Added AIRIS. Modified Aperto Series to Aperto.
14	06/23/06	Added GSPS SCU feature.

Table of Contents

1.   Introduction

1.1   Purpose of this Document

This document is the DICOM Conformance Statement for the Hitachi MR Imaging system. It provides a high level description of the DICOM capabilities of the Application Entity used in the MR scanners. The document is formatted according to DICOM PS3.2 (2003).
It is intended to facilitate the process of interconnection between the Hitachi scanners and other DICOM 3.0 compliant devices. This document by itself however, does not guarantee interconnectivity or interoperability with other devices. To ensure the interconnectivity, connectivity validation test may be required.
This document is applied to the system software version 5.1 and the following systems.

1.2   Related Documents

NEMA PS3.1-15(2004), the DICOM Standard

1.3   Definitions

Application Entity - Is the Term used for the software application capable of using DICOM services.
ARserver - The name of the Image Archive and Restore Application Entity running on the Hitachi MRI system.
DCserver - The name of the Image Transfer Application Entity running on the Hitachi MRI system.
HCserver - The name of the Print Management Application Entity running on the Hitachi MRI system.
MWL Component -   The name of the Modality Worklist Management Application Entity running on the Hitachi MRI system.
MPPS Component - The name of the Modality Performed Procedure Step Application Entity running on the Hitachi MRI system.
Daemon - An application that runs in the background without human intervention.

1.4   Acronyms and Abbreviations

The following acronyms and abbreviations are used in this conformance specification.

ACR	American College of Radiology
AE	Application Entity
API	Application Programming Interface
CA	Certificate Authority
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
GUI	Graphical User Interface
IOD	Information Object Definition
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	North American Electrical Manufacturers Association
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UI	User Interface
UID	Unique Identifier
VR	Value Representation

E1E-BM5440

2.   Implementation Model

2.1   Image Transfer and Storage Commitment

The Hitachi MR DICOM Image Transfer Server (*DCserver*) is implemented as a single Application Entity.

Once it has a configuration, *DCserver* is capable of:
- accepting associations from remote AEs wishing to Query/Retrieve/Store Information Objects in the local database or wishing to establish verification association,
- accepting associations from remote AEs wishing to respond to Storage Commitment requests originated by the Hitachi MRI system, and
- initiating associations to Query/Retrieve/Store/Commit Information Objects in remote AE's

2.1.1 Application Data Flow Diagram
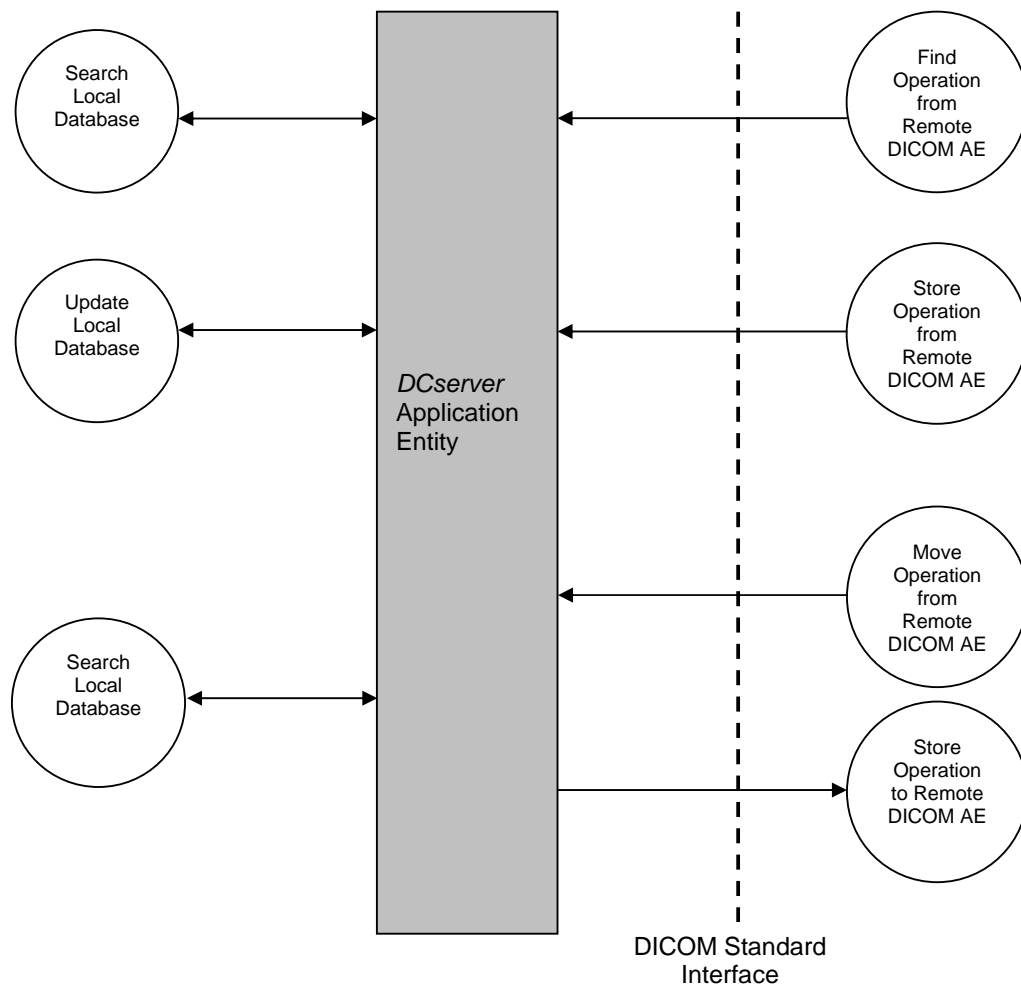
Figure 1   Image Transfer Implementation Model

E1E-BM5440
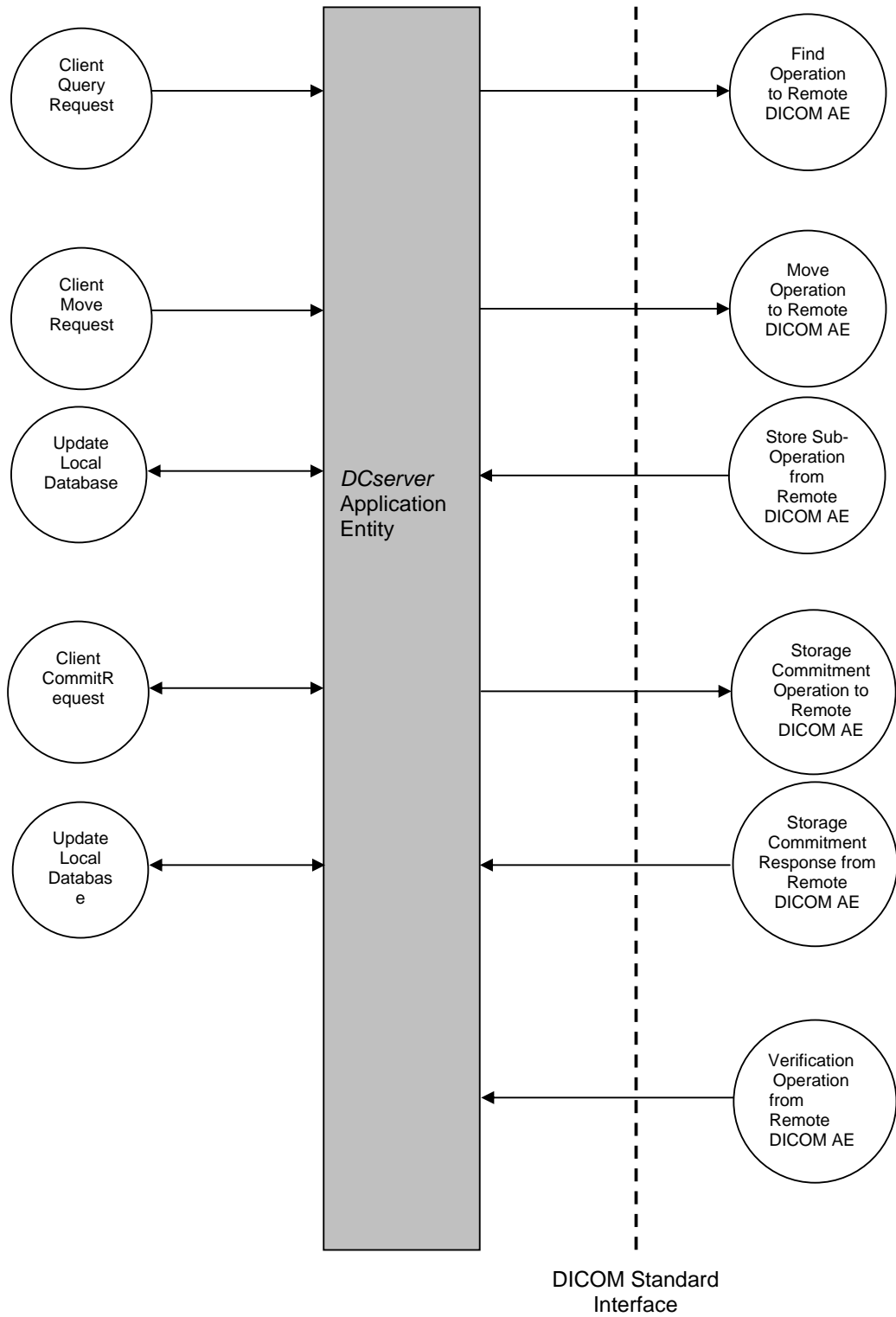
**Figure 1 Image Transfer Implementation Model (Continued)**

Figure 1 illustrates the following scenarios:
1. Process Find requests from a remote DICOM AE; search the local database for matches and return the requested information.
2. Process Store requests from a remote DICOM AE; update the local database with the object to be stored and return Store responses.
3. Process Move requests from a remote DICOM AE; initiate Store operations to the destination AE and return Move responses to the move requestor AE.
4. Initiate Find operations to a DICOM AE in response to a query request from Hitachi MRI system's GUI application.
5. Initiate Move operations to a DICOM AE in response to a move request from Hitachi MRI system's GUI application. This may result in Store sub-operation from a remote DICOM AE.
6. Initiate Storage Commitment requests to a DICOM AE in response to a commit request from Hitachi MRI system's GUI application.
7. Process Storage Commitment replies from a remote DICOM AE; update the local database accordingly.
8. Process Verification requests from a remote DICOM AE.

2.1.2 Functional Definitions of Application Entities

The *DCserver* operates as a daemon. The startup sequence of the Hitachi MRI system initiates its execution. The *DCserver* terminates when the Hitachi MRI system is shut down.

The *DCserver* uses a configuration file that contains information used to validate association attempts from remote Application Entities. The *DCserver* then listens on the configured port for association requests.

An association request for Storage Services from a remote Application Entity causes the *DCserver* to validate the request according to the configuration parameters set at execution-time. The remote Application Entity then sends the Information Object Instance. The *DCserver* stores the received Information Object Instance in its local database if the data does not already exist. The data remains in the database until removed by the local user of the Hitachi MRI system.

An association request from a remote Application Entity for Query or Move Services causes the *DCserver* to validate the request according to the configuration parameters set at execution time. The remote Application Entity then sends the Query or Retrieve request. The *DCserver* searches the local database for the instance(s) specified. If the request was C-FIND, then a response is returned for each match. If the request was C-MOVE, then an association is originated to the destination Application Entity specified in the C-MOVE message. Incremental responses are sent to the C-MOVE originator to indicate progress of the request.

A request from the Hitachi MRI system's GUI application causes the *DCserver* to initiate an association with a remote Application Entity. The user can then initiate query and retrieve requests to the *DCserver* that are sent to the remote Application Entity. The Hitachi MR User Interface displays the responses from the remote Application Entity.

Associations establish and release requests are logged to the UNIX syslog daemon (*syslogd)* as *local7.info* messages. Various error and warning indications are also logged using *syslogd.*

2.1.3 Sequencing of Real-World Activities

It is expected that requests for Storage Commitment will only be made by the application after successful transfer of the related SOP Instances to a remote AE. This is not enforced, however, since the user can request Storage Commitment manually for the images of any patient, study, or series available on the local system. It is therefore possible that a Storage Commitment request may be issued before successful transfer of the related SOP Instances.

2.2 Print Management

The Hitachi MR DICOM Hardcopy Server (*HCserver*) is implemented as a single Application Entity. It only initiates associations with a remote Print SCP for the purposes of transferring hardcopy related communications.

This *HCserver* accepts commands from the MR user through a Graphical User Interface. The User Interface allows the user to prepare and submit print operations to the *HCserver*.

2.2.1 Application Data Flow Diagram
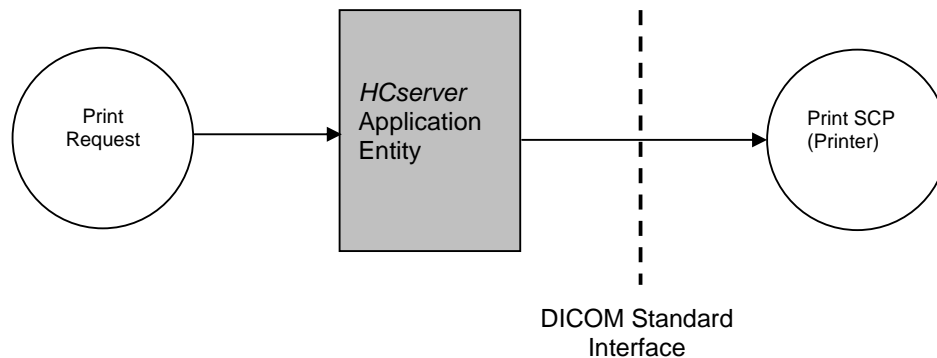
Figure 2   Print Management Implementation Model

The Hitachi MR user submits a print job to the *HCserver* via inter-process client/server communications. The *HCserver* proceeds to initiate an association to a specific Basic Grayscale Print Management Meta Service Class Provider. The hardcopy information is then sent to the printer over this established association using the accepted DICOM protocol.

2.2.2 Functional Definitions of Application Entities

The *HCserver* component operates as a daemon. The startup sequence of the Hitachi MRI system initiates its execution. The *HCserver* is shut down when the Hitachi MR system terminates.

The *HCserver* uses a configuration file that contains information used to configure supported remote Print SCPs.

A request from the Hitachi MRI system's GUI application causes the *HCserver* component to initiate an association with a Remote Application Entity. The Hitachi MR User Interface displays relevant status and error responses from the Remote Application Entity.

Association and release requests are logged to the UNIX syslog daemon (*syslogd)* as *local7.info* messages. Various error and warning indications are also logged using *syslogd*.

2.2.3 Sequencing of Real-World Activities

Not applicable.

2.3 Basic Worklist Management

The Hitachi MRI system software is implemented as a single application entity (*MWL Component*) to support Basic Worklist Management. The *MWL Component* implements the Basic Worklist Management Service, DICOM PS3.4, Annex K.

2.3.1 Application Data Flow Diagram

The following figure depicts the application data flow.
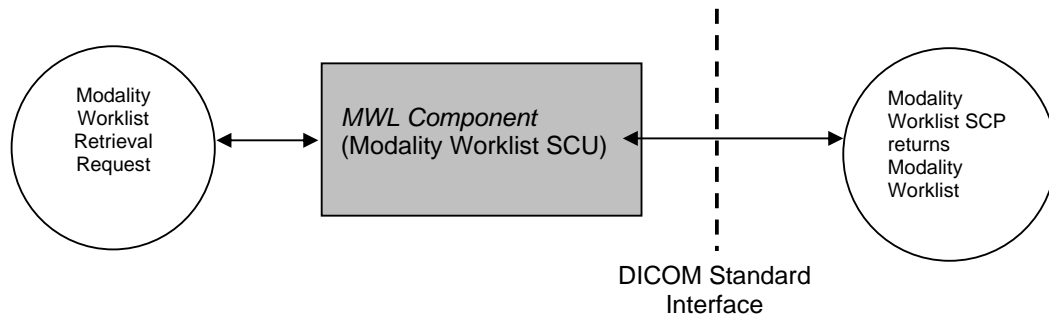
Figure 3   Modality Worklist Data Flow Diagram

The Hitachi MR user initiates Modality Worklist retrieval requests by interacting with *MWL Component* through the Graphical User Interface. The *MWL Component* initiates an association with the remote Application Entity and uses the Basic Modality Worklist Service Class to retrieve Worklists. The remote Application Entity responds to the request and send Worklists to the *MWL Component*. The *MWL Component* presents the retrieved Worklists to the Hitachi MR user through the Graphical User Interface.

The Hitachi MRI application automatically initiates the Modality Worklist retrieval request when the Hitachi MR user starts scheduled procedures. The retrieved Worklists are used to validate the scheduled procedures.

2.3.2 Functional Definitions of Application Entities

MWL Component acts as a Modality Worklist SCU in order to retrieve a Modality Worklist from a Modality Worklist SCP. In particular, *MWL Component*

1.   Specify the AE Title of the Modality Worklist SCU (*MWL Component*)
2.   Specify the AE Title, Host Name, Port Number of the Modality Worklist SCP
3.   Specify the Required/Optional Matching Key Attributes
4.   Request Modality Worklist Retrieval
5.   Cancel Modality Worklist Retrieval[1]
6.   Access Individual Items of Modality Worklist
7.   Access Individual Attributes of Modality Worklist Item

When the Hitachi MR user issues a request to retrieve a Modality Worklist, the *MWL Component* initiates an Association to the Modality Worklist SCP.

When the Association has been established, *MWL Component* sends a C-FIND request to the Modality Worklist SCP to retrieve a Modality Worklist.

When the Modality Worklist has been received, the Hitachi MR user is notified about the availability of the Modality Worklist.

The Hitachi MR user can access all Items of the Modality Worklist. The Hitachi MR user can also access all attributes of all Items.

After the last C-FIND response is received, the *MWL Component* releases the association to the Modality Worklist SCP

2.3.3 Sequencing of Real-World Activities

Not applicable.

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[1] Cancel is not available to the user, however, the application may cancel a query in some exceptional situations.

2.4 Modality Performed Procedure Step

The Hitachi MRI system is implemented as a single application entity (*MPPS Component*) to support Modality Performed Procedure Step. The *MPPS Component* implements the Modality Performed Procedure Step SOP Class, DICOM PS3.4, and Annex F.7.

2.4.1 Application Data Flow Diagram

The following figure depicts the application data flow.
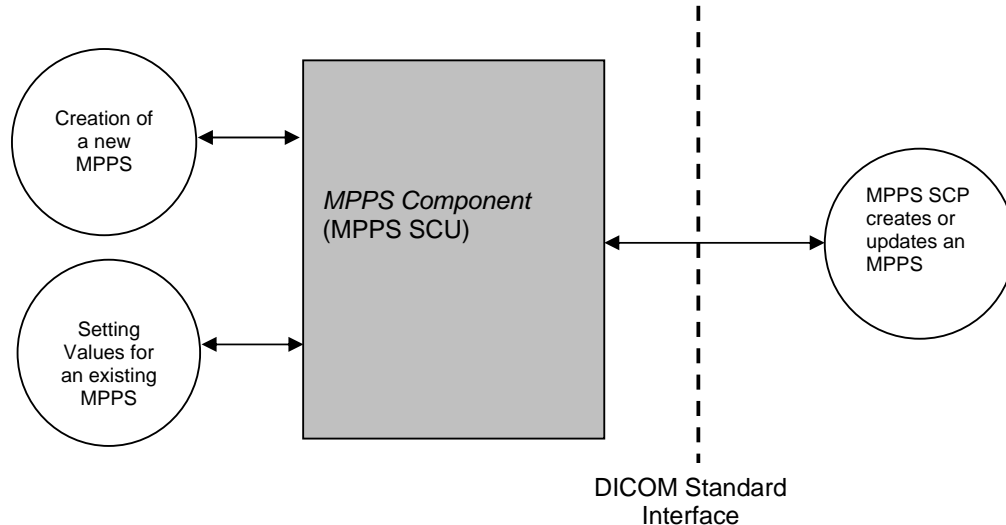
Figure 4   MPPS Implementation Model

MPPS Component initiates N-CREATE or N-SET requests to a remote DICOM AE (Modality Performed Procedure Step SCP) in response to a user request to create or update a performed procedure step or to an automatic creation of a performed procedure step caused by initiation of image creation. The application will create the MPPS with "IN PROGRESS" status, and may update with the MPPS with "COMPLETED" or "DISCONTINUED" status.

2.4.2 Functional Definitions of Application Entities

MPPS Component acts as an MPPS SCU in order to notify the MPPS SCP about the start and the end of the procedure step. More specially, *MPPS Component*;

1. Provides the AE Title of the MPPS SCU (*MPPS Component*)
2. Provides the AE Title, Host Name and Port Number of the MPPS SCP
3. Issues a connect request in order to see what operations the remote SCP supports
4. Requests the MPPS SCP to create a new MPPS or update/set some values for an existing one. The *MPPS Component*;
    - Sends an N-CREATE or N-SET request to the MPPS SCP. The request contains the set of attributes that should be used for creating a new step or updating an existing step (See **Annex D**).
    - Receives N-CREATE/N-SET responses and notifies the Hitachi MRI system about the completion of creation of a new step or updating of an existing step.
5. Disconnects from remote MPPS SCP

When *MPPS Component* issues a request to create an MPPS on the SCP, it initiates an association to the MPPS SCP. If successful, an N-CREATE operation is performed against the MPPS SCP. After completion of the operation, the assocaition is closed.

When *MPPS Component* issues a request to set some values for an existing MPPS on the SCP, it initiates an association to the MPPS SCP. If successful, and N-SET operation is performed against the MPPS SCP. After completion of the operation, the association is closed.

E1E-BM5440

2.4.3 Sequencing of Real-World Activities

MPPS component will first create a MPPS on SCP and then attempt to set/update some values in it.

2.5   Media Storage

The Hitachi MR Archive Server (*ARserver*) is implemented as a single application entity that creates and/or updates 5 1/4 inch MOD, 120mm DVD-RAM and 120mm CD-R with various DICOM SOP instances. For the rest of the document we refer to media as one of the following 2.3GB and 2.6GB MOD, 4.7 GB and 9.4 GB DVD-RAM and 640MB and 700MB CD-R.

2.5.1 Application Data Flow Diagram
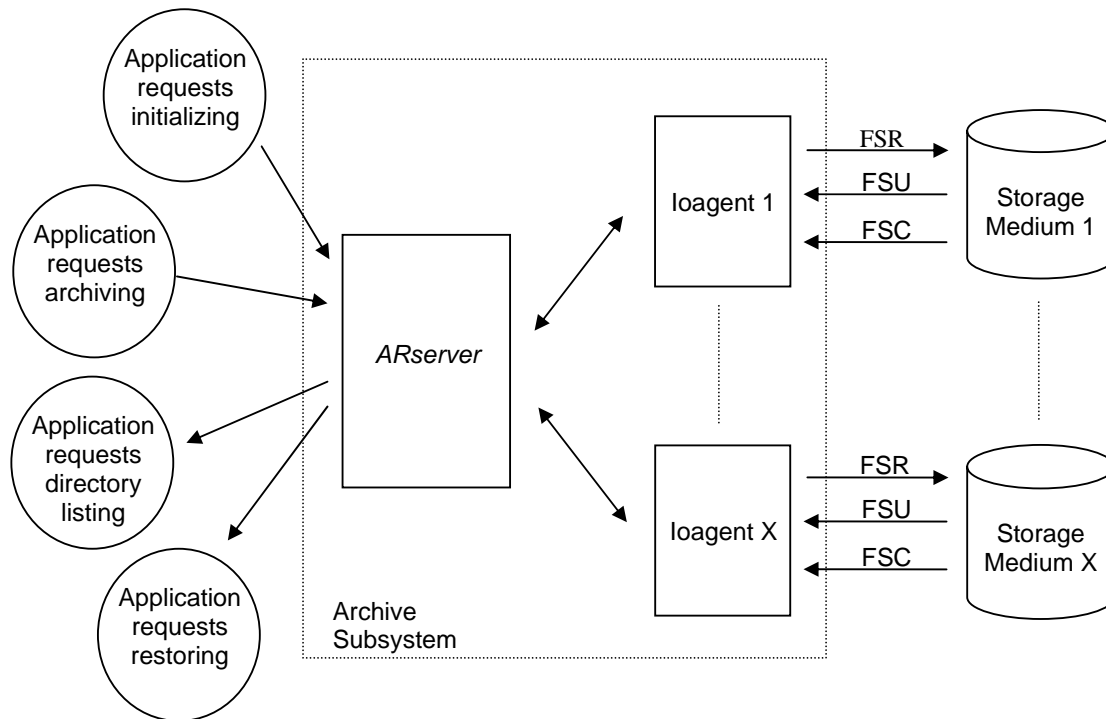
Figure 5   Media Storage Management Implementation Model

One *ARserver* may connect to one or more *Ioagent*. Each *Ioagent* connects to a media drive. The *ARserver* may have a local/remote storage media that may contain various SOP instances. These may have been obtained by original creation, network transfer or by removable media using other application entities. These instances are external to this conformance statement and outside the scope of this document

The Hitachi MRI system's GUI application submits media requests to *ARserver* via internal client/server mechanism. The *ARserver* then processes those requests and accesses, via *Ioagent*, the media according to Media Storage Service Class defined in PS 3.4 with the interchange option. The *ARserver* accesses, via *Ioagent*, the media acting as one of following roles FSC(File-set Creator), FSU(File-set Updater) and FSR(File-set Reader), defined in PS 3.10.

2.5.2 Functional Definitions of Application Entities

The *ARserver* is a single application entity that operates as a daemon. The startup sequence of the Hitachi MRI system initiates its execution. The *ARserver* terminates when the Hitachi MRI system is shut down.

A request from the Hitachi MRI application causes the *ARserver* to interpret the request and act, in a sequence of operations(driven by request type), as a FSU, FSC and/or FSR to complete the request received from the Hitachi MRI system's GUI application. e.g. if an initialize request is received then *ARserver* will act as a FSC to generate a basic Directory SOP Class in DICOMDIR file with all types of Directory Records related to the SOP Classes stored in the File-set.

The set of operations that *ARserver* can perform are as following:

- initialize a new media, by writing a new DICOM file-set onto the media;

- display a directory listing of a DICOM file-set on the media. The listing is provided to the user in response to a query.

- copy SOP instances from the media to local storage.

- update the DICOM file-set media with new SOP instances.

Various error and warning indications are logged to the UNIX syslog daemon (*syslogd)* as *local7.info* messages.

2.5.3 Sequencing of Real-World Activities

- A directory listing can only be performed on a piece of MOD or DVD-RAM media that has already had a DICOM file-set created.
- A directory listing must be requested on a piece of MOD or DVD-RAM media before performing an update operation.
- A copy operation can only be performed on a piece of MOD or DVD-RAM media that had performed an update operation.

2.5.4 File Meta Information Options

Implementation Class UID and Implementation Version Name are specified in the *ARserver*'s configuration file.

E1E-BM5440

3. Image Transfer Application Entity Specifications

The Hitachi MRI system's DICOM Image Transfer capability consists of two logical components (SCU and SCP).
The SCU portion originates associations for Store, Query, Retrieve and Storage Commitment operations. The SCP portion accepts associations for Store, Query and Retrieve operations. The SCU portion will also accept associations to negotiate a role selection of SCU for Storage Commitment responses that are sent on a different association than the request. The two components are configured with the same Application Entity Title for use in the Hitachi MR Application. They are treated as a single Application Entity in this description.

The *DCserver* Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCP:

Table 1 Image Transfer SOP Class UID for Image Transfer SCP

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Patient Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
SC Image Storage	1.2.840.10008.5.1.4.1.1.7

The *DCserver* Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 2 Image Transfer SOP UID for Image Transfer SCU

SOP Class Name	SOP Class UID
Study Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2
Storage Commitment Push Model	1.2.840.10008.5.1.20.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
SC Image Storage	1.2.840.10008.5.1.4.1.1.7
GSPS Storage	1.2.840.10008.5.1.4.1.1.11.1

3.1 Association Establishment Policies
3.1.1 General

The Hitachi MRI system's GUI allows the user to select the Application Entity to associate with for Store, Query, Retrieve and Storage Commitment operations. The configuration file contains the configuration parameters such as host name, port number and specific SOP Classes to negotiate for each accessible Application Entity.

The *DCserver* will respond to association requests from remote AEs, however, it will only accept associations from those remote AEs on which it has knowledge. And it will only accept those Presentation Contexts that it is configured to support for the specific requesting AE. The AEs can be configured to allow or deny any service on a per remote AE basis.

The *DCserver* Application Entity always accepts the Verification SOP Class.

The maximum length of PDU that the *DCserver* will receive is 65536.

3.1.2 Number of Associations

The *DCserver* can initiate multiple associations concurrently.

3.1.3 Asynchronous Nature

The *DCserver* does not support multiple outstanding transactions.

3.1.4 Implementation Identifying Information

The *DCserver* Implementation Class UID is **1.2.392.200036.9123.100.12.11.yyyymmdd**. The appended year corresponds to the date of the official Hitachi MRI system software release in which DICOM functionality changes warrant Implementation Class UID changes. The version name is formatted as follows:

HMC_MR_HMY_<major>_<minor>_<revision>

3.2 Association Initiation by Real World Activity

This section details the action of the *DCserver* SCU component as a result of user initiated activity on the Hitachi MR console.

3.2.1 Query Request

3.2.1.1 Associated Real World Activity

The user of the Hitachi MRI system selects the "Query" operation on the user interface. Wild card or specific information can be specified by the user for Patient Name and/or Patient ID.

Query will also be issued before a move request to verify the existence of images with a Study or Series.

3.2.1.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Query request.
The configuration file contains 1 of the listed Abstract Syntax's.

Table 3 Presentation Context Table for Query Request

Presentation Context Table						
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query / Retrieve 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
Study Root Query / Retrieve 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
Storage Commitment Push Model	1.2.840.10008.5.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.1.3 SOP Specific Conformance for Patient Root Query/Retrieve Model - FIND

Although this service class is presented in the association request initiated by the *DCserver,* it is not actually utilized.

3.2.1.4 SOP Specific Conformance for Study Root Query/Retrieve Model - FIND

The *DCserver* does not use Extended Negotiation.

The *DCserver* does not negotiate Relational Queries.

The Keys supported are listed below:

Table 4 Study Level Keys

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	U
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Referring Physician's Name	(0008,0090)	O
Private Current Body Part	(0019,157B)	O
Private Current Laterality	(0019,157F)	O
Private Number Of Images	(0019,1594)	O

Table 5 Series Level Keys

Description	Tag	Type
Modality	(0008,0060)	R
Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U
Acquisition Type	(0018,0023)	O
Sequence	(0018,0020)	O
Sequence Name	(0018,0024)	O
Contrast Agent	(0018,0010)	O
Private Series Name	(0019,1552)	O
Private Procedure Type	(0019,126B)	O
Private Section	(0019,1201)	O
Private TR	(0019,1269)	O
Private TE	(0019,126A)	O
Private Number Of Images	(0019,1595)	O

Table 6 Image Level Keys

Description	Tag	Type
SOP Instance UID	(0008,0018)	U

3.2.2 Move Request

3.2.2.1 Associated Real World Activity

There are three methods that the user can use to initiate move requests.

The first method is a manual method. The user of the Harmony MR application selects the source Application Entity and one or more patients, studies, and/or series within studies from a list presented as a result of a previous Query operation of that source. The destination Application Entity Title is also selectable on the User Interface. The user then selects the "Send" operation on the user interface to initiate the move operation.

The second method is an automatic method. This is used to automatically transfer the output IODs of an operation after the operation has created them. The user selects the destination Application Entities in advance of running the operation, and then after the operation is

E1E-BM5440

completed, the IODs are sent automatically to that destination. If these are image IODs, this occurs as soon as the images are saved to the local database. If these are GSPS IODs, this occurs at specific triggers within the application that cause GSPSs to be captured.

The third method is also a manual method, but more similar to the automatic method. It is used to send the current operation output images and the related GSPSs to the selected destinations on-demand when the user invokes the transfer.

Note that, in the latter two methods, the source is not selectable by the user since they are, by definition, push operations from the local database.

3.2.2.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Move request.

Table 7 Presentation Context Table for Move Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query / Retrieve 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
Study Root Query / Retrieve 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
Storage Commitment Push Model	1.2.840.10008.5.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.2.3 SOP Specific Conformance for Patient Root Query/Retrieve Model - MOVE

This implementation supports transfers against the Patient Query/Retrieve Information Model described in Section C.6.1.1 of NEMA PS3.4 Annex C using the C-MOVE SCU behavior described in Section C.4.2.2 of NEMA PS3.4 Annex C. Although this service class is presented in the association request initiated by the *DCserver,* it is not actually utilized.

3.2.2.4 SOP Specific Conformance for Study Root Query/Retrieve Model - MOVE

The *DCserver* supports transfers against the Study Query/Retrieve Information Model described in Section C.6.2.1 of DICOM PS3.4 Annex C using the C-MOVE SCU behavior described in Section C.4.2.2 of DICOM PS3.4 Annex C.

3.2.3 Store Request

3.2.3.1 Associated Real World Activity

The *DCserver* Application Entity initiates an association for C-STORE if it has received a valid C-MOVE message from a local use of Hitachi MRI system or a remote Application Entity. The SOP Class UID of the Information Object to be sent over the C-STORE context is used to verify that a valid Presentation Context exists prior to issuing the C-STORE message. A mismatch results in no message being sent but the association remains active.

E1E-BM5440

3.2.3.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Store request.

Table 8 Presentation Context Table for Store Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
GSPS Storage	1.2.840.10008.5.1.4.1.1.11.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None

3.2.3.3 SOP Specific Conformance for C-STORE

The *DCserver* Application Entity supports transfers as an SCU as described in DICOM PS3.4 Annex B.

The status returned by the accepting Application Entity is used to indicate success or failures of the C-MOVE sub-operation which initiated the transfer. In no case is the Information Object deleted from the local database.

Extended negotiation is not used by *DCserver* for this SOP Class.

The common Information Object Definitions content that are sent with the C-STORE request are specified in Annex A of this document. In addition to this, the following attributes may also be included for both image and GSPS IODs, except where noted:

Table 9 Additional Attributes Sent in C-STORE

Description	Tag	Comment
Window Center	(0028,1050)	Not sent for GSPS IODs.
Window Width	(0028,1051)	Not sent for GSPS IODs.
Referenced Image Sequence	(0008,1140)	Refers to the planning image related to this image. Inclusion is conditional on configuration. Not sent for GSPS IODs.
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	
Referenced Study Sequence	(0008,1110)	If MPPS is used, this information is included.
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	
Request Attributes Sequence	(0040,0275)	If MPPS is used, this information is included.
> Requested Procedure ID	(0040,1001)	
> Scheduled Procedure Step ID	(0040,0009)	
> Scheduled Procedure Step Description	(0040,0007)	
> Scheduled Protocol Code Sequence	(0040,0008)	
Code Value	(0008,0100)	
Coding Scheme Designator	(0008,0102)	
Coding Scheme Version	(0008,0103)	
Code Meaning	(0008,0104)	
Performed Procedure Step ID	(0040,0253)	If MPPS is used, this information is included.
Performed Procedure Step Start Date	(0040,0244)	If MPPS is used, this information is included.

E1E-BM5440

Performed Procedure Step Start Time	(0040,0245)	If MPPS is used, this information is included.
Performed Procedure Step Description	(0040,0254)	If MPPS is used, this information is included.
Performed Protocol Code Sequence	(0040,0260)	If MPPS is used, this information is included. Currently this can only be included if the performed protocols are the same as the scheduled protocols and the configuration is set to copy the value from the MWL to the MPPS.
Procedure Code Sequence	(0008,1032)	If MPPS is used, this information is included.
> Code Value	(0008,0100)	
> Coding Scheme Designator	(0008,0102)	
> Coding Scheme Version	(0008,0103)	
> Code Meaning	(0008,0104)	
Referenced Study Component Sequence	(0008,1111)	If MPPS is used, this information is included.
> Referenced SOP Class UID	(0008,1150)	
> Referenced SOP Instance UID	(0008,1155)	

3.2.4 Storage Commitment Request

3.2.4.1 Associated Real World Activity

There are two events that may cause a Storage Commitment association request to occur. If the application is so configured, the Storage Commitment request may be made automatically after successful completion of a move operation from the local AE to a remote AE. Alternatively, the user may select a set of patients, studies, or series from a previous query request and manually request Storage Commitment for these items from a selectable AE (if more than one Storage Commitment AE is configured).

3.2.4.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Storage Commitment request.

Table 10 Presentation Context Table for Storage Commitment Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query / Retrieve 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
Study Root Query / Retrieve 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
Storage Commitment Push Model	1.2.840.10008.5.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.4.3 SOP Specific Conformance for Storage Commitment Push Model

The mechanisms available to get *DCserver* to transfer SOP Instances are described in Section 3.2.1, 3.2.2 and 3.2.3.

3.2.4.3.1 Operations

Storage commitment requests are generated under the conditions described in Section 3.2.4.1.

DCserver can request storage commitment for any SOP Instance in the local database.

The Transaction UID is applicable for the duration of the transaction, and there is no specific time limit imposed on receipt of the storage commitment result. In a case that the result is not received within a timeout period, the user will be informed and may cancel the request. This will not result in a cancel request to the Storage Commitment SCP, but will cause the result to be ignored if it is received in the future. In case the user chooses to retry and the result is not received within a configured lifetime the request is discarded on next startup of the system and any further response to this request will be ignored.

DCserver does not perform extended negotiation for these SOP Classes and does not perform any validation of outgoing DICOM datasets. *DCserver* does not support the optional Storage Media File-Set ID and UID attributes in the storage commitment request.

3.2.4.3.2 Notifications

DCserver does not delete SOP Instances regardless of the storage commitment result. Hitachi MRI system may not allow a user with normal permissions to delete data sets that have not been committed (depending on the security features installed on the system and user role).

Messages to the system's application log file (local7.info) are generated for unsuccessful storage commitment results.

3.3   Association Acceptance by Real World Activity

DCserver is association acceptance on the basis of Called Application Entity Title, Calling Application Entity Title and SOP Class UID matching.

3.3.1 Verification Association Request

3.3.1.1 Associated Real-World Activity

The *DCserver* receives an association request for verification service from a remote AE.

3.3.1.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Table 11 Accepted Presentation Contexts Table for Verification Association Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.1.3 SOP Specific Conformance for Verification

The *DCserver* Application Entity conforms to the DICOM Verification Service Class as an SCP. Extended negotiation is not supported.

A single response is generated for the request. If the association is successfully negotiated, a success status code of 0x0000 is always returned.

3.3.1.4 Presentation Context Acceptance Criterion

The *DCserver* always accepts the Verification SOP Class. The possible Presentation Contexts are listed in section 3.3.1.2.

3.3.1.5 Transfer Syntax Selection Policies

The *DCserver* supports only the default DICOM Little-endian Transfer Syntax.

3.3.2 Query Association Request

3.3.2.1 Associated Real-World Activity

The *DCserver* searches the attached database for the requested Information Objects described in the C-FIND identifier and returns a response for each match.

3.3.2.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Table 12 Presentation Context Table for Query Association Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Patient Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Query / Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.2.3 SOP Specific Conformance for Patient Root Query/Retrieve Model - FIND

The *DCserver* Application Entity conforms to the DICOM Patient Root Query/Retrieve Service Class as an SCP for the Abstract Syntax's listed in the table in section 3.3.2.2. It accepts as search keys all attributes from Patient, Study and Series level, see Patient Root Query/Retrieve Information Model for the entire set of attributes.

The following tables define the accepted search keys.

Table 13 Patient Level Keys for Patient Root Query/Retrieve Model

Description	Tag	Type
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	R

Table 14 Study Level Keys for Patient Root Query/Retrieve Model

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Referring Physician's Name	(0008,0090)	O
Private Current Body Part	(0019,157B)	O
Private Current Laterality	(0019,157F)	O
Private Number Of Images	(0019,1594)	O

Table 15 Series Level Keys for Patient Root Query/Retrieve Model

Description	Tag	Type

Modality	(0008,0060)	R
Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U
Acquisition Type	(0018,0023)	O
Sequence	(0018,0020)	O
Sequence Name	(0018,0024)	O
Contrast Agent	(0018,0010)	O
Private Series Name	(0019,1552)	O
Private Procedure Type	(0019,126B)	O
Private Section	(0019,1201)	O
Private TR	(0019,1269)	O
Private TE	(0019,126A)	O
Private Number Of Images	(0019,1595)	O

Table 16 Image Level Keys for Patient Root Query/Retrieve Model

Description	Tag	Type
SOP Instance UID	(0008,0018)	U

A response is returned for each match found in the attached database.

Note. Due to insertion criteria on Patient Name and Patient ID there could be situations where duplicates of both Patient ID and Study Instance UID's provided; for the case where duplicated Study Instance UID's are provided duplicated entities contain exactly same information.

Possible response status values are:

Table 17 Response Status for Patient Root Query/Retrieve Model FIND Request

Refused	Out of resources	A700
Failed	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	Matching completed	0000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.2.4 SOP Specific Conformance for Study Root Query/Retrieve Model - FIND

The *DCserver* Application Entity conforms to the DICOM Study Root Query/Retrieve Service Class as an SCP for the Abstract Syntax's listed in the table in section 3.3.2.2. It accepts as search keys all attributes from Study and Series level, see Study Root Query/Retrieve Information Model for the entire set of attributes.

Table 18 Study Level Keys for Study Root Query/Retrieve Model

Description	Tag	Type
Study Date	(0008,0020)	R
Study Time	(0008,0030)	R
Accession Number	(0008,0050)	R
Patient's Name	(0010,0010)	R
Patient ID	(0010,0020)	R
Study ID	(0020,0010)	R
Study Instance UID	(0020,000D)	U
Referring Physician's Name	(0008,0090)	O
Private Current Body Part	(0019,157B)	O
Private Current Laterality	(0019,157F)	O
Private Number Of Images	(0019,1594)	O

Table 19 Series Level Keys for Study Root Query/Retrieve Model

Description	Tag	Type

Modality	(0008,0060)	R
Series Number	(0020,0011)	R
Series Instance UID	(0020,000E)	U
Acquisition Type	(0018,0023)	O
Sequence	(0018,0020)	O
Sequence Name	(0018,0024)	O
Contrast Agent	(0018,0010)	O
Private Series Name	(0019,1552)	O
Private Procedure Type	(0019,126B)	O
Private Section	(0019,1201)	O
Private TR	(0019,1269)	O
Private TE	(0019,126A)	O
Private Number Of Images	(0019,1595)	O

Table 20 Image Level Keys for Study Root Query/Retrieve Model

Description	Tag	Type
SOP Instance UID	(0008,0018)	U

A response is returned for each match found in the attached database.

Note. Due to insertion criteria on Patient Name and Patient ID there could be situations where duplicates of both Patient ID and Study Instance UID's provided; for the case where duplicated Study Instance UID's are provided duplicated entities contain exactly same information.

Possible response status values are:

Table 21 Response Status for Study Root Query/Retrieve Model FIND Request

Refused	Out of resources	A700
Failed	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	matching completed	0000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.2.5 Presentation Context Acceptance Criterion

The *DCserver* accepts SOP Class contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.2.2.

3.3.2.6 Transfer Syntax Selection Policies

The *DCserver* supports only the default DICOM Little-endian Transfer Syntax.

3.3.3 Move Association Request

3.3.3.1   Associated Real-World Activity

The *DCserver* initiates an association to the destination Application Entity specified in the C-MOVE command message. The *DCserver* then extracts the requested Information Objects described in the C-MOVE identifier from the attached database and performs C-STORE operations on the destination association.

3.3.3.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Table 22 Presentation Context Table for Move Association Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Patient Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
Study Root Query / Retrieve Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.3.3 SOP Specific Conformance for Patient Root Query/Retrieve Model - MOVE

The *DCserver* Application Entity conforms to the DICOM Patient Root Query/Retrieve Service Class as an SCP for the Abstract Syntax's listed in the table in section 3.3.3.2.

A response is returned for each Information Object sent to the destination Application Entity Possible response status values are:

Table 23 Response Status for Patient Root Query/Retrieve Model MOVE Request

Refused	Out of resources	A700
	Move Destination Unknown	A801
Failed	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	sub-operations completed	0000
Warning	sub-operations completed, 1 or more failures	B000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.3.4 SOP Specific Conformance for Study Root Query/Retrieve Model - MOVE

The *DCserver* Application Entity conforms to the DICOM Study Root Query/Retrieve Service Class as an SCP for the Abstract Syntax's listed in the table in section 3.3.3.2.

A response is returned for each Information Object sent to the destination Application Entity. Possible response status values are:

Table 24 Response Status for Study Root Query/Retrieve Model MOVE Request

Refused	Out of resources	A700
	Move Destination Unknown	A801
Failed	Unable to Process	C000
Cancel	Terminated due to Cancel Request	FE00
Success	sub-operations completed	0000
Warning	sub-operations completed, 1 or more failures	B000
Pending	Matches are continuing	FF00

The attribute 0x00000902 contains a descriptive message to explain error returns.

3.3.3.5 Presentation Context Acceptance Criterion

The *DCserver* accepts SOP Class contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.3.2.

3.3.3.6 Transfer Syntax Selection Policies

The *DCserver* supports only the default DICOM Little-endian Transfer Syntax.

E1E-BM5440

3.3.4 Storage Association Request

3.3.4.1 Associated Real-World Activity

The *DCserver* receives an association request for storage service from a remote AE.
The *DCserver* stores image Information Object Instances received on the accepted
association into the database of the Hitachi MRI system.

3.3.4.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity
configuration file specifies which of these Presentation Contexts are actually used in a specific
configuration.

Table 25 Presentation Context Table for Store Association Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR, Little Endian	1.2.840.10008.1.2	SCP	None

3.3.4.3 SOP Specific Conformance for SOP Class Storage

The *DCserver* Application Entity conforms to the DICOM Storage Service Class as an SCP for
the Abstract Syntax's listed in the table in section 3.3.4.2 at conformance level 2. Storage
Conformance level 2 requires the Application Entity to retain all Type 1, Type 2 and Type 3
attributes. Annex A of this document specifies the attributes retained from the Storage SOP
Class Information Objects listed in section 3.3.4.2.

The received Information Object Instance is stored in a database until the user of Hitachi MRI
system causes the data to be deleted. The Hitachi MRI system's GUI application accesses
the stored data for display.

Private attributes which are not recognized as valid Hitachi MRI system's private attribute sets
are discarded.

A response is returned for each Information Object received from the Storage SCU.
Possible response status values are:

Table 26 Response Status for Storage Request

Refused	Out of resources	A701
Failed	Identifier does not match SOP Class	A900
	Unable to Process	C001
Success	sub-operations completed	0000

The attribute 0x00000902 contains a descriptive message to explain error returns.

Annex B of this document describes the validations and coercion performed on incoming
Information Objects. Failure of a validation results in the return of status C001 in the C-
STORE response message.

3.3.4.4 Presentation Context Acceptance Criterion

The *DCserver* accepts Storage SOP Class Presentation Contexts if they are configured in the
Application Entity configuration file. The possible Presentation Contexts are listed in section
3.3.4.2.

E1E-BM5440

3.3.4.5 Transfer Syntax Selection Policies

The *DCserver* supports only the default DICOM Little-endian Transfer Syntax.

3.3.5 Storage Commitment Association Request

3.3.5.1 Associated Real-World Activity

The *DCserver* receives an association request from a Storage Commitment SCP that did not respond to a Storage Commitment request from the *DCserver* on the original association.

3.3.5.2 Presentation Context Table

The following table lists the possible Presentation Contexts. The Application Entity configuration file specifies which of these Presentation Contexts are actually used in a specific configuration.

Table 27 Presentation Contexts Accepted for Storage Commitment Association Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Storage Commitment Push Model	1.2.840.10008.5.1.20.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	SCU/SCP Role Selection

3.3.5.3 SOP Specific Conformance for SOP Class - Storage Commitment Push as SCU

3.3.5.3.1 Operations

A single response is returned for the Storage Commitment response from the Storage Commitment SCP.
Possible response status values are:

Table 28 Response Status for Storage Commitment Response Processing

Success	Operation completed	0x0000
Fail	Unable to Process	0x0110
	Identifier does not match SOP Class	0x0118

In the case where the user of the Hitachi MRI system cancels a Storage Commitment request due to a long delay in the response or due to lifetime limit, a subsequent response from the Storage Commitment SCP will not result in the series being marked as committed.

3.3.5.3.2 Notifications

DCserver generates a storage commitment result once it has updated, successfully or not, the database records for the SOP Instance(s) that were committed.

In the case where the user of the Hitachi MRI system cancels a Storage Commitment request due to a long delay in the response or due to lifetime limit, a subsequent response from the Storage Commitment SCP will not result in a notification to the Hitachi MR system.

DCserver does not support the optional Storage Media File-Set ID and UID attributes nor the optional Retrieve AETitle attribute in the storage commitment result.

3.3.5.4 Presentation Context Acceptance Criterion

The *DCserver* accepts Storage Commitment SOP Class Presentation Contexts if they are configured in the Application Entity configuration file. The possible Presentation Contexts are listed in section 3.3.5.2.

3.3.5.5 Transfer Syntax Selection Policies

The *DCserver* supports only the default DICOM Little-endian Transfer Syntax.

4. Print Application Entity Specifications

The Hitachi MRI system's DICOM Print capability (*HCserver*) consists of only a SCU component. The SCU portion originates associations for printing operations.

The *HCserver* Application Entity provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 29 Print Management Meta SOP Class UID

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9
Presentation LUT SOP	1.2.840.10008.5.1.1.23

4.1 Association Establishment Policies
4.1.1 General

The Hitachi MRI User Interface supports more than one DICOM capable imager. The *HCserver* configuration file contains the configuration parameters such as host name, port number and AE title for that Application Entity.

The *HCserver* maintains a separate association with each DICOM SCP. It releases the association with the DICOM SCP if no operation is done on the association in a selected time period.

4.1.2 Number of Associations

The *HCserver* is capable of initiating multiple associations concurrently.   There is no real limit on the number of associations that can be originated. There will be one association opened for each configured SCP.

4.1.3 Asynchronous Nature

The *HCserver* does not support multiple outstanding transactions.

4.1.4 Implementation Identifying Information

The *HCserver* Implementation Class UID is **1.2.392.200036.9123.100.12.11.2.yyyymmdd**. The appended year corresponds to the date of the official Hitachi MRI system software release in which DICOM Print functionality changes warrant Implementation Class UID changes. The version name is formatted as follows:

HMC_MR_PRN_<major_minor_revision>

4.2 Association Initiation by Real World Activity
This section details the action of the *HCserver* as a result of user initiated activity on the Hitachi MRI User Interface.

4.2.1 Print Request

4.2.1.1 Associated Real World Activity

The user of the Hitachi MRI Application selects the "Print" operation on the user interface, or has enabled automatic or programmed filming for an operation.

4.2.1.2 Proposed Presentation Contexts

The following table describes the Presentation Contexts that may be presented for the Print request.
The configuration file contains 1 of the listed Abstract Syntax's.

Table 30 Presentation Context Table for Print Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Implicit VR, Little Endian	1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR, Little Endian	1.2.840.10008.1.2.1	SCU	None
Basic Grayscale Print Management Meta	1.2.840.10008.5.1.1.9	Explicit VR, Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.1.3 SOP Specific Conformance for Basic Grayscale Print Management Meta

The *HCserver* supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class:

Table 31 Print Management SOP Class UID

SOP Class Name	SOP Class UID
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16

The *HCserver* supports the following mandatory and optional SOP class attributes and DIMSE services for the Basic Grayscale Print Management Meta SOP Class.

Table 32 Print Management DIMSE Services

SOP Class	DIMSE Service	Optional Attribute	Tag
Basic Film Session SOP Class	N-CREATE	Number of Copies	(2000,0010)
		Print Priority	(2000,0020)
		Medium Type	(2000,0030)
		Film Destination	(2000,0040)
		Film Session Label	(2000,0050)
		Memory Allocation	(2000,0060)
Basic Film Box SOP Class	N-CREATE	Image Display Format	(2010,0010)
		Referenced Film Session Sequence	(2010,0500)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
		Referenced Presentation LUT Sequence	(2050,0500)
		>Referenced SOP Class UID	(0008,1150)
		>Referenced SOP Instance UID	(0008,1155)
		Film Orientation	(2010,0040)
		Film Size ID	(2010,0050)
		Magnification Type	(2010,0060)
		Max Density	(2010,0130)
		Configuration Information	(2010,0150)
		Smoothing Type	(2010,0080)

		Border Density	(2010,0100)
		Empty Image Density	(2010,0110)
		Min Density	(2010,0120)
		Trim	(2010,0140)
		Illumination	(2010,015E)
		Reflected Ambient Light	(2010,0160)
	N-ACTION		
	N-DELETE		
Basic Grayscale Image Box SOP Class	N-SET	Image Position	(2020,0010)
		Polarity	(2020,0020)
		Magnification type	(2010,0060)
		Smoothing type	(2010,0080)
		Requested Image Size	(2020,0030)
		Basic Grayscale Image Sequence	(2020,0110)
		>Samples Per Pixel	(0028,0002)
		>Photometric Interpretation	(0028,0004)
		>Rows	(0028,0010)
		>Columns	(0028,0011)
		>Pixel Aspect Ratio	(0028,0034)
		>Bits Allocated	(0028,0100)
		>Bits Stored	(0028,0101)
		>High Bit	(0028,0102)
		>Pixel Representation	(0028,0103)
		>Pixel Data	(7FE0,0010)
Printer SOP Class	N-EVENT-REPORT	Printer Status Info	(2110,0020)
	N-GET	Printer Status	(2110,0010)
		Printer Status Info[2]	(2110,0020)
		Printer Name	(2110,0030)
		Manufacturer	(0008,0070)
		Manufacturer Model Name	(0008,1090)
		Device Serial Number	(0018,1000)
		Software Versions	(0018,1020)

4.2.1.4 SOP Specific Conformance for Presentation LUT SOP

The *hcserver* supports the following SOP class attributes and DIMSE services for the Presentation LUT SOP Class.

Table 33 Presentation LUT DIMSE Services

SOP Class	DIMSE Service	Optional Attribute	Tag
Basic Presentation LUT SOP Class	N-CREATE	Presentation LUT Sequence	(2050,0010)
		>LUT Descriptor	(0028,3002)
		>LUT Explanation	(0028,3003)
		>LUT Data	(0028,3006)
		Presentation LUT Shape	(2050,0020)
	N-DELETE		

4.3   Association Acceptance by Real World Activity

The *HCserver* does not accept association requests.

---

[2] The *HCserver* supports mapping of these status messages to generic messages to allow a uniform, consistent message to its clients. The Hitachi MRI's GUI application then represents these messages uniformly to its users regardless of printer being supported.

5. Modality Worklist Application Entity Specifications

5.1 SOP Class Conformance

The *MWL Component* of the Hitachi MRI system is capable of providing Standard Conformance to the following DICOM V3.0 SOP Classes as SCU:

Table 34 Modality Worklist SOP Class UID

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

5.2 Association Establishment Policies

5.2.1 General

When *MWL Component* issues a request to retrieve a Modality Worklist, it initiates an Association to the Modality Worklist SCP. *MWL Component* assumes the maximum PDU length to be 16384 bytes.

5.2.2 Number of Associations

MWL Component can initiate multiple associations concurrently. The maximum number of Associations which can be initiated is service user configurable. When *MWL Component* has retrieved a Modality Worklist from a Modality Worklist SCP, *MWL Component* releases the Association to the Modality Worklist SCP.

5.2.3 Asynchronous Nature

MWL Component will allow only one pending C-FIND request per Association. Therefore, *MWL Component* will not support asynchronous operations and will not perform asynchronous window negotiation.

5.2.4 Implementation Identifying Information

The format of the *MWL Component* Implementation Class UID is
1.2.392.200036.9123.100.12.11.2. <yyyymmdd>.
The format of the version name is **HMC_MR_MWL_<major>_<minor>_<revision>**.

5.3 Association Initiation by Real World Activity

This section details the action of the *MWL Component* as a result of user initiated activity on the Hitachi MRI User Interface.

5.3.1 Modality Worklist Retrieval Request

5.3.1.1 Associated Real-World Activity

When the user of the Hitachi MRI issues a request to retrieve a Modality Worklist, *MWL Component* initiates an Association to the Modality Worklist SCP. The Hitachi MRI User Interface also issues a request automatically in order to retrieve a specific Worklist when the user starts scheduled procedures.

5.3.1.2 Proposed Presentation Context

The following table describes the Presentation Contexts that are presented for the FIND request.

Table 35 Presentation Context Table for Establishing Modality Worklist Association

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Worklist Information Model - FIND	1.2.840.1000 8.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

5.3.1.3 SOP Specific Conformance for Modality Worklist Information Model - FIND

The *MWL Component* supports the following search keys as SCU.

Table 36 Search Keys for Modality Worklist Information Model - FIND

Attribute Name	Tag	Type
Scheduled Station AE Title	(0040, 0001)	R
Scheduled Procedure Step Start Date	(0040, 0002)	R
Modality	(0008, 0060)	R
Patient ID	(0010, 0020)	R
Accession Number	(0008, 0050)	O

Return keys supported by the *MWL Component* are listed in **Annex C** of this document. The following return keys are copied to MR Image IOD which is generated by the Hitachi MRI system.

Table 37 Return Keys copied to MR Image IOD

Worklist		MR Image IOD	
DICOM Tag	Parameter Name	DICOM Tag	Parameter Name
(0008,0050)	Accession Number	(0008,0050)	Accession Number
(0008,0090)	Referring Physician's Name	(0008,0090)	Referring Physician's Name
(0010,0010)	Patient Name	(0010,0010)	Patient Name
(0010,0020)	Patient ID	(0010,0020)	Patient ID
(0010,0030)	Patient Birth Date	(0010,0030)	Patient Birth Date
(0010,0040)	Patient Sex	(0010,0040)	Patient Sex
(0010,1010)	Patient Age	(0010,1010)	Patient Age
(0010,1030)	Patient Weight	(0010,1030)	Patient Weight
(0010,4000)	Patient Comment	(0010,4000)	Patient Comment
(0020,000D)	Study Instance UID	(0020,000D)	Study Instance UID
(0032,1060)	Requested Procedure Description	(0008,1030)	Study Description
(0040,0002)	Scheduled Procedure Step Start Date	(0008,0020)	Study Date
(0040,0003)	Scheduled Procedure Step Start Time	(0008,0030)	Study Time
(0040,0006)	Scheduled Performing Physician Name	(0008,1050)	Performing Physician's Name

5.4 Association Acceptance by Real World Activity

The *MWL Component* does not accept association requests.

6.   <u>MPPS Entity Specifications</u>

The *MPPS Component* of the Hitachi MRI system is capable of providing Standard Conformance to the following DICOM V3.0 SOP Classes as SCU:

Table 38 Modality Worklist SOP Class UID

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

6.1   Association Establishment Policies
6.1.1 General

MPPS Component initiates an Association to the MPPS SCP in response to a user of Hitachi MRI system request to create or update an MPPS or to an automatic creation of an caused by initiation of image creation. When *MPPS Component* has created or set an MPPS to the MPPS SCP, *MPPS Component* releases the Association to the MPPS SCP.

6.1.2 Number of Associations

MPPS Component can initiate multiple associations concurrently. The maximum number of Associations which can be initiated is service user configurable.

6.1.3 Asynchronous Nature

The *MPPS Component* will allow only one pending request on an Association (being it N-CREATE or N-SET). Therefore, *MPPS Component* will not support DICOM asynchronous operations and will not perform asynchronous window negotiation.

6.1.4 Implementation Identifying Information

The format of the *MPPS Component* Implementation Class UID is
1.2.392.200036.9123.100.12.11.2. <yyyymmdd>.
The format of the version name is **HMC_MR_PPS_<major>_<minor>_<revision>**.

6.2   Association Initiation by Real World Activity
This section details the action of the *MPPS Component* as a result of user initiated activity on the Hitachi MRI User Interface.

6.2.1 MPPS Association Request

6.2.1.1   Associated Real-World Activity

When the user of the Hitachi MRI system issues a request to create or update an MPPS, *MPPS Component* initiates an Association to the MPPS SCP.

 The Hitachi MRI system issues a request automatically in order to create an MPPS when the user starts scheduled procedures. The Hitachi MRI system also issues a request automatically in order to update an MPPS when the user finishes the scheduled procedures.

6.2.1.2 Proposed Presentation Context

The following table lists the Presentation Contexts offered to the MPPS SCP at the time the Association is established. The *MPPS Component* does not negotiate SCU/SCP Role Selection and assumes SCU.

Table 39 Presentation Context Table for Establishing MPPS Association

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Modality Performed Procedure Step Model	1.2.840.1000 8.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

6.2.1.3 SOP Specific Conformance for MPPS Model - FIND

MPPS Component supports attributes in the **Annex C**. Modality Worklist attributes copied to MPPS SOP Instance are specified in **Annex E**.

6.3   Association Acceptance by Real World Activity

The *MPPS Component* does not accept association requests.

7. Media Storage Application Entity Specification

The *ARserver* Application Entity provides Standard Conformance to DICOM Interchange option of the Media Storage Service Class. The Application Profiles and Roles are listed in the following table:

Table 40 Application Profiles Supported

Application Profiles Supported	Real World Activity	Role	Service Class Option
STD-CTMR-MOD23 and STD-CTMR-DVD-RAM	Initialize Media Update Media Display Directory Copy to Local Storage	FSC FSU FSR FSR	Interchange Interchange Interchange Interchange
STD-CTMR-CD	Write to CD-R	FSC	Interchange

[MOD and DVD]
The *ARserver* will detect existence of a DICOM file-set in a media when is inserted in the drive.
When the *ARserver* cannot find a DICOM file-set (DICOMDIR), it will notify Hitachi MRI system's GUI application.
The *ARserver* on initialize will format and update the media with empty DICOM file-set (DICOMDIR).
The *ARserver* will support MOD 2.3GB, MOD 2.6GB, DVD-RAM4.7GB and DVD-RAM9.4GB media type as long as the media is formatted according to DICOM specification in PS 3.12.
The *ARserver* will support copy to local storage or update of SOP instances from/to the media for the SOP Class UID listed in table below.

[CD-R]
The *ARserver* writes DICOM file-set (single DICOMDIR and zero or more DICOM files) to CD-R media. The *ARserver* supports CD-R 640MB and CD-R 700MB.

Table 41 SOP Classes Supported

Application Profiles	SOP Class Name	SOP Class UID
STD-CTMR-MOD23 and STD-CTMR-DVD-RAM	MR Image Storage	1.2.840.10008.5.1.4.1.1.4
	SC Image Storage	1.2.840.10008.5.1.4.1.1.7
	Folder Routine	1.2.392.200036.9123.100.12.11.3
	Task Card	1.2.392.200036.9123.100.12.11.2
	Routine	1.2.392.200036.9123.100.12.11.1
STD-CTMR-CD	MR Image Storage	1.2.840.10008.5.1.4.1.1.4
	SC Image Storage	1.2.840.10008.5.1.4.1.1.7
	Folder Routine	1.2.392.200036.9123.100.12.11.3

Table 42 Transfer Syntaxes Supported for reading of SOP instances

Transfer Syntax Name	Transfer Syntax UID
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2

Table 43 Transfer Syntaxes Supported for storage of SOP instances

Transfer Syntax Name	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1

7.1 File Meta Information for the Application Entity

Application AE title is set as following:
HITACHIx – where x is an index that represents device number associated with installed device

7.2 Real World Activities for this Application Entity

7.2.1 Real World Activity : Initialize Media

The *ARserver* acts as an FSC using the interchange option when requested to initialize media.

7.2.1.1 Application Profiles for the RWA : Initialize Media

For the list of application profiles that invoke this AE for the Initialize Media, see the table named "**Application Profiles Supported**" in section 7.

7.2.2 Real World Activity : Directory Listing

The *ARserver* acts as an FSR using the interchange option when requested to provide a directory listing.
When the *ARserver* is requested to provide a directory listing, it will read the DICOM file-set (DICOMDIR) and display the record entries according to the user query. The *ARserver* will only return records that match the Hitachi MR application query.

7.2.2.1 Application Profiles for the RWA : Directory Listing

For the list of application profiles that invoke this AE for the Directory Listing, see the table named "**Application Profiles Supported**" in section 7.

7.2.3 Real World Activity : Copy to Local Storage

The *ARserver* acts as an FSR using the interchange option when copying from the media to local storage.
The *ARserver* will copy any SOP instance selected from a media directory list from the media to local storage upon request. The copy request is in a form of user query. The *ARserver* will only copy any SOP instance that matches the user query to local storage.

7.2.3.1 Application Profiles for the RWA : Copy to Local Storage

For the list of application profiles that invoke this AE for the Copy to Local Storage, see the table named "**Application Profiles Supported**" in section 7.

7.2.4 Real World Activity : Update Media

The *ARserver* acts as an FSU using the interchange option when requested to update a media. The *ARserver* will take the select list of SOP instances and eliminate any SOP instance not belonging to the SOP Class listed in the table named "**SOP Classes Supported**" in section 7. The remaining SOP instances are written to the media.

7.2.4.1 Application Profiles for the RWA : Update Media

For the list of application profiles that invoke this AE for the Update Media, see the table named "**Application Profiles Supported**" in section 7.

7.2.5 Real World Activity : Write to CD-R

The *ARserver* acts as an FSC using the interchange option when requested to archive a Patient data to CD-R media.
The *ARserver* will take the select list of SOP instances and eliminate any SOP instance not belonging to the SOP Class listed in the table named "**SOP Classes Supported**" in section 7. The remaining SOP instances are written to the media.

7.2.5.1 Application Profiles for the RWA : Write to CD-R

For the list of application profiles that invoke this AE for the Write to CD-R, see the table named "**Application Profiles Supported**" in section 7.

8. Communication Profiles

8.1 Supported Communication Stacks (Parts 8,9)
The TCP/IP Network Communication Support as defined in DICOM Part 8 is supported.

8.1.1 OSI Stack

The OSI stack is not supported.

8.1.2 TCP/IP Stack

8.1.2.1 API

The *DCserver, HCserver, MWL Component and MPPS Component* use Berkeley style sockets.

8.1.2.2 Physical Media Support

The Hitachi MRI system supports a single 10 base-T/100 base-TX Ethernet connection. The *DCserver, HCserver, MWL Component and MPPS Component* are not dependent on the physical medium used for the TCP/IP network other than its effect on performance. This feature is a result of using the SUN-OS Unix operating system in the Hitachi MRI system.

8.1.3 Point-to-Point Stack

Not supported.

9. Extensions/Specialization's/Privatization's

9.1 Standard/Extended/Specialized/Private SOPs
Not applicable.

9.2 Private Transfer Syntax's
Not applicable.

9.3 SOP Class Extension
9.3.1 *DCserver* SOP Class Extension

The supported SOP classes have been extended to provide support for private attributes.

9.3.2 *HCserver* SOP Class Extension

Not applicable.

9.3.3 *MWL Component* SOP Class Extension

Not applicable.

9.3.4 *MPPS Component* SOP Class Extension

Not applicable.

9.3.5 *ARserver* SOP Class Extension

The supported SOP classes have been extended to provide support for private attributes.

E1E-BM5440

10. Security Profiles

10.1 Image Transfer and Storage Commitment Security Profile
DCserver provides conformance to the following Security Profiles defined in PS3.15.

10.1.1   Basic TLS Secure Transport Connection Profile

DCserver accepts and initiates TLS connections from/to an AE Title when is configured to do so.

As an Association Acceptor, *DCserver* always asks for the Association Requestor's certificate when security is enabled, if this is set and a valid certificate is not presented, the TLS connection request is denied.
If during an exchange of DICOM data, *DCserver* detects message tampering through an integrity check failure, the Association is aborted. The provider reason will be REASON-NOT-SPECIFIED as defined by DICOM in PS3.8; an implementation-specific reason may be used in a future version of *DCserver*.

DCserver supports the following features of the Basic TLS Secure Transport Profile:
- support for the profile can be enabled or disabled for each DICOM SCU instantiation
- TLS_RSA_WITH_3DES_EDE_CBC_SHA and TLS_RSA_WITH_NULL_SHA cipher suites
- X.509 certificate in PEM format
- private key in PEM format
- certificates of trusted CAs in PEM format

10.2 Print security profile
HCserver provides conformance to the following Security Profiles defined in PS3.15.

10.2.1   Basic TLS Secure Transport Connection Profile

*HC*server supports the following features of the Basic TLS Secure Transport Profile:
- support for the profile can be enabled or disabled for each DICOM SCU instantiation
- TLS_RSA_WITH_3DES_EDE_CBC_SHA and TLS_RSA_WITH_NULL_SHA cipher suites
- X.509 certificate in PEM format
- private key in PEM format
- certificates of trusted CAs in PEM format

10.3 MWL security profile
MWL Component provides conformance to the following Security Profiles defined in PS3.15.

10.3.1   Basic TLS Secure Transport Connection Profile

The *MWL Component* supports the following features of the Basic TLS Secure Transport Profile:
- support for the profile can be enabled or disabled
- TLS_RSA_WITH_3DES_EDE_CBC_SHA and TLS_RSA_WITH_NULL_SHA cipher suites
- X.509 certificate in PEM format
- private key in PEM format
- certificates of trusted CAs in PEM format

10.4 MPPS security profile

MPPS Component provides conformance to the following Security Profiles defined in PS3.15.

10.4.1 Basic TLS Secure Transport Connection Profile

MPPS Component supports the following features of the Basic TLS Secure Transport Profile:
- support for the profile can be enabled or disabled
- TLS_RSA_WITH_3DES_EDE_CBC_SHA and TLS_RSA_WITH_NULL_SHA cipher suites
- X.509 certificate in PEM format
- private key in PEM format
- certificates of trusted CAs in PEM format

10.5 Media security profile

ARserver provides conformance to the following Security Profiles defined in PS3.15.

10.5.1 Basic DICOM Media Security Profile

ARserver supports the following features of the Basic DICOM Media Security Profile:
- support for the profile can be enabled or disabled in the configuration file
- Encapsulation of a DICOM File in a Secure DICOM File by below methods
- Enveloped-data content type of the Cryptographic Message Syntax defined in RFC 2630
- Triple-DES content-encryption
- RSA [RFC 2313] for the key transport of Triple-DES content-encryption keys.
- SHA-1 digest algorithm
- X.509 certificate in PEM format
- private key in PEM format

E1E-BM5440

11. Configuration

11.1 AE Title/Presentation Address Mapping

The *DCserver, HCserver, MWL Component and MPPS Component* Application Entity maps Application Entity Titles to host names and port numbers via lookups in the configuration file. The IP address for a host name is determined using standard UNIX system calls. The configuration file also supports the use of IP addresses in place of host names.

11.2 Configurable Parameters

DCserver, *HCserver*, *MWL Component, MPPS Component and ARserver* have the following configurable pamamenters. Modifications to these configurations, however, should be limited to appropriate Hitachi Medical Corporation, Hitachi Medical Systems America, or other Hitachi Medical Systems authorized servicing personnel.

11.2.1 DICOM Image Transfer and Storage Commitment Configurations

- AE title, host name, IP address, alias, description and port number of the *DCserver*
- AE title, host name, IP address, alias, description and port number of remote AEs
- SOP Classes supported by the *DCserver* as an SCU and an SCP
- SOP Classes supported by remote AEs as an SCU and an SCP
- TCP/IP connection timeout
- Number of associations
- Dynamic range of image pixel data (12bit or 16bit range)
- Bits Stored and High Bit for when dynamic range of image pixel data is set to 12
- String for Contrast Agent (0018,0010) for the case when Contrast Agent is not used
- If private attributes are imported and exported
- If Referenced Image SOP Sequence (0008,1140) is transferred or not
- If parameters for scan and image post-processing are imported and exported as part of private attributes
- The timeout to wait for a Storage Commitment response
- The lifetime for Storage Commitment responses
- Enable/disable Security Profile
- Cipher suites for the secure communications

11.2.2 DICOM Print Configurations

- AE title, host name and IP address of the *HCserver*
- Model name, AE title, IP address and port number of imagers/spoolers
- The final destination imager's model name for each spoolers
- Minimam density and Maximum density
- Supported media types and media sizes
- Enable/disable Security Profile
- Cipher suites for the secure communications
- Number of copies

11.2.3 Modality Worklist Configurations

- AE title, host name and IP address of the *MWL Component*
- AE title, host name, IP address and port number of the MWL SCP
- Number of associations
- Enable/disable Security Profile
- Cipher suites for the secure communications

11.2.4 MPPS Configurations

- AE title, host name and IP address of the *MPPS Component*
- AE title, host name, IP address and port number of the MPPS SCP
- Number of associations

- Enable/disable Security Profile
- Cipher suites for the secure communications

11.2.5　　　Media Storage Configurations

- Cipher suites for the secure communications

12. <u>Support of Extended Character Sets</u>

Extended character sets are not supported.

E1E-BM5440

Annex A

This annex details the common Information Object Definitions content transmitted and /or stored by the *DCserver* Application Entity. They contain Type 1, Type 2 and Type 3 attributes for conformance to Storage Conformance level 2 defined in DICOM Part 3, Information Object Definitions PS3.3.
The table numbers in this annex match those in DICOM Part 3, Information Object Definitions PS3.3.

A.1   Common Modules

Table A-1 Patient Module Attributes

Attribute Name	Tag	Type
Patient's Name	0010,0010	2
Patient ID	0010,0020	2
Patient's Birth Date	0010,0030	2
Patient's Sex	0010,0040	2
Patient Comments	0010,4000	3

Table A-2 General Study Module Attributes

Attribute Name	Tag	Type
Study Instance UID	0020,000D	1
Study Date	0008,0020	2
Study Time	0008,0030	2
Referring Physician's Name	0008,0090	2
Study ID	0020,0010	2
Accession Number	0008,0050	2
Study Description	0008,1030	3

Table A-3 Patient Study Module Attributes

Attribute Name	Tag	Type
Patient's Age	0010,1010	3
Patient's Weight	0010,1030	3

Table A-4 General Series Module Attributes

Attribute Name	Tag	Type
Modality	0008,0060	1
Series Instance UID	0020,000E	1
Series Number	0020,0011	2
Laterality	0020,0060	2C
Series Date	0008,0021	3
Series Time	0008,0031	3
Performing Physicians' Name	0008,1050	3
Protocol Name	0018,1030	3
Series Description	0008,103E	3
Operators' Name	0008,1070	3
Body Part Examined	0018,0015	3
Patient Position	0018,5100	2C

Table A-5 Frame Of Reference Module Attributes

Attribute Name	Tag	Type
Frame of Reference UID	0020,0052	1
Position Reference Indicator	0020,1040	2

Table A-6 General Equipment Module Attributes

Attribute Name	Tag	Type
Manufacturer	0008,0070	2
Institution Name	0008,0080	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

Table A-7 General Image Module Attributes

Attribute Name	Tag	Type
Image Number	0020,0013	2
Patient Orientation	0020,0020	2C
Image Date	0008,0023	2C
Image Time	0008,0033	2C
Image Type	0008,0008	3
Acquisition Number	0020,0012	3
Acquisition Date	0008,0022	3
Acquisition Time	0008,0032	3
Image Comments	0020,4000	3

Table A-8 Image Plane Module Attributes

Attribute Name	Tag	Type
Pixel Spacing	0028,0030	1
Image Orientation (Patient)	0020,0037	1
Image Position (Patient)	0020,0032	1
Slice Thickness	0018,0050	2
Slice Location	0020,1041	3

Table A-9 Image Pixel Module Attributes

Attribute Name	Tag	Type
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	1
Rows	0028,0010	1
Columns	0028,0011	1
Bits Allocated	0028,0100	1
Bits Stored	0028,0101	1
High Bit	0028,0102	1
Pixel Representation	0028,0103	1
Pixel Data	7FE0,0010	1
Planar Configuration	0028,0006	1C
Pixel Aspect Ratio	0028,0034	1C
Smallest Image Pixel Value	0028,0106	3
Largest Image Pixel Value	0028,0107	3

Table A-10 Contrast/Bolus Module Attributes

Attribute Name	Tag	Type
Contrast/Bolus Agent	0018,0010	2
Contrast/Bolus Start Time	0018,1042	3

A.2 MR Storage IOD

Table A-11 MR Image Module Attributes

Attribute Name	Tag	Type
Image Type	0008,0008	1
Samples per Pixel	0028,0002	1
Photometric Interpretation	0028,0004	1
Bits Allocated	0028,0100	1
Scanning Sequence	0018,0020	1
Sequence Variant	0018,0021	1
Scan Options	0018,0022	2
MR Acquisition Type	0018,0023	2
Repetition Time	0018,0080	2C
Echo Time	0018,0081	2
Echo Train Length	0018,0091	2
Inversion Time	0018,0082	2C
Trigger Time	0018,1060	2C
Sequence Name	0018,0024	3
Angio Flag	0018,0025	3
Number of Averages	0018,0083	3
Imaging Frequency	0018,0084	3
Imaged Nucleus	0018,0085	3
Echo Number	0018,0086	3
Magnetic Field Strength	0018,0087	3
Spacing Between Slices	0018,0088	3
Number of Phase Encoding Steps	0018,0089	3
Percent Sampling	0018,0093	3
Percent Phase Field of View	0018,0094	3
Nominal Interval	0018,1062	3
Heart Rate	0018,1088	3
Reconstruction Diameter	0018,1100	3
Receiving Coil	0018,1250	3
Acquisition Matrix	0018,1310	3
Phase Encoding Direction	0018,1312	3
Flip Angle	0018,1314	3
Cardiac Number of Images	0018,1090	3

A.3 SC Storage IOD

Table A-12 SC Image Module Attributes

Attribute Name	Tag	Type
Conversion Type	0008,0064	1

A.4 GSPS Storage IOD

Table A-13 Presentation Series Module Attributes

Attribute Name	Tag	Type
Modality	0008,0060	1

Table A-14 Presentation State Module Attributes

Attribute Name	Tag	Type
Instance Number	0020,0013	1
Presentation Label	0070,0080	1
Presentation Description	0070,0081	2
Presentation Creation Date	0070,0082	1
Presentation Creation Time	0070,0083	1
Presentation Creator's Name	0070,0084	2
Referenced Series Sequence	0008,1115	1

Attribute Name	Tag	Type
>Series Instance UID	0020,000E	1C
>Referenced Image Sequence	0008,1140	1C
>>Referenced SOP Class UID	0008,1150	1C
>>Referenced SOP Instance UID	0008,1155	1C

Table A-15 Overlay Plane Module Attributes

Attribute Name	Tag	Type
Overlay Rows	60xx,0010	1
Overlay Columns	60xx,0011	1
Overlay Type	60xx,0040	1
Overlay Origin	60xx,0050	1
Overlay Bits Allocated	60xx,0100	1
Overlay Bit Position	60xx,0102	1
Overlay Data	60xx,3000	1C

Table A-16 Overlay/Curve Activation Module Attributes

Attribute Name	Tag	Type
Overlay Activation Layer	60xx,1001	2C

Table A-17 Displayed Area Module Attributes

Attribute Name	Tag	Type
Displayed Area Selection Sequence	0070,005A	1
>Referenced Image Sequence	0008,1140	1C
>>Referenced SOP Class UID	0008,1150	1C
>>Referenced SOP Instance UID	0008,1155	1C
>Displayed Area Top Left Hand Corner	0070,0052	1
>Displayed Area Bottom Right Hand Corner	0070,0053	1
>Presentation Size Mode	0070,0100	1
>Presentation Pixel Spacing	0070,0101	1C
>Presentation Pixel Magnification Ratio	0070,0103	1C

Table A-18 Graphic Annotation Module Attributes

Attribute Name	Tag	Type
Graphic Annotation Sequence	0070,0001	1
>Referenced Image Sequence	0008,1140	1C
>>Referenced SOP Class UID	0008,1150	1C
>>Referenced SOP Instance UID	0008,1155	1C
>Graphic Layer	0070,0002	1
>Text Object Sequence	0070,0008	1C
>>Anchor Point Annotation Units	0070,0004	1C
>>Unformatted Text Value	0070,0006	1
>>Anchor Point	0070,0014	1C
>>Anchor Point Visibility	0070,0015	1C
>Graphic Object Sequence	0070,0009	1C
>>Graphic Annotation Units	0070,0005	1
>>Graphic Dimensions	0070,0020	1
>>Number of Graphic Points	0070,0021	1
>>Graphic Data	0070,0022	1
>>Graphic Type	0070,0023	1
>>Graphic Filled	0070,0024	1C

Table A-19 Spatial Transformation Module Attributes

Attribute Name	Tag	Type
Image Rotation	0070,0042	1
Image Horizontal Flip	0070,0041	1

Table A-20 Graphic Layer Module Attributes

Attribute Name	Tag	Type

E1E-BM5440

Graphic Layer Sequence	0070,0060	1
>Graphic Layer	0070,0002	1
>Graphic Layer Order	0070,0062	1
>Graphic Layer Recommended Display RGB Value	0070,0067	3
>Graphic Layer Description	0070,0068	3

Table A-21 Softcopy VOI LUT Module Attributes

Attribute Name	Tag	Type
Softcopy VOI LUT Sequence	0028,3110	1
>Referenced Image Sequence	0008,1140	1C
>>Referenced SOP Class UID	0008,1150	1C
>>Referenced SOP Instance UID	0008,1155	1C
>VOI LUT Sequence	0028,3010	1C
>>LUT Descriptor	0028,3002	1C
>>LUT Data	0028,3006	1C
>Window Center	0028,1050	1C
>Window Width	0028,1051	1C

Table A-22 Softcopy Presentation LUT Module Attributes

Attribute Name	Tag	Type
Presentation LUT Shape	2050,0020	1C

E1E-BM5440

<u>Annex B</u>

This Annex describes the coercions and validity checks performed on Information Objects being imported via *DCserver*. It also describes the insertion criteria at each level of the Hitachi MR stored hierarchy.

B.1   Validity Checks

1. Invalid or missing orientation vector values (0x00200037) results in rejection of MR Information Objects. These vectors are considered invalid if their angle is more than one half of one degree than 90 degrees or if their vectors are not or cannot be coerced to values where their dot product is accurate to less than 10^{-6}.

2. A missing Photo Interpretation attribute (0x00280004) results in rejection of any modality Information Object.

3. Photo Interpretation values (0x00280004) other than MONOCHROME1, MONOCHROME2 result in rejection of MR Information objects.

4. Missing Bits Allocated, Bits Used and High Bit attributes result in rejection of any modality Information Object.

B.2   Coercions

1. Patient orientation value (0x00200020) is coerced based on the orientation vector value (0x00200037) for MR Information Objects.

2. Image orientation value (0x00200037) is a set of orthogonal vectors. If their dot product is not accurate to less than 10^{-6} and their angle is within one half of one degree of 90 degrees, the vectors will be modified to make them accurately orthogonal (i.e. to a point where their dot product is accurate to less than 10^{-6}.)

3. If Pixel Padding Value (0x00280120) is present, the pixel values are adjusted accordingly.

4. Pixel data overlay bits are masked out, i.e. when overlays are embedded in upper bits of allocated pixel data.

B.3   Insertion Criteria

Patient	Patient ID	(0010,0020)
Patient	Patient Name	(0010,0010)
Study	Study Instance UID	(0020,000D)
Series	Series Instance UID	(0020,000E)
Image	SOP Instance UID	(0008,0018)

Annex C

This annex details the actual Return keys for Modality Worklist Information Model -FIND request.

Table C-1 Return Keys for Modality Worklist Information Model - FIND

Attribute Name	Tag	Type
Specific Character Set	0008,0005	1C
Scheduled Procedure Step Sequence	0040,0100	1
>Scheduled Station AE Title	0040,0001	1
>Scheduled Procedure Step Start Date	0040,0002	1
>Scheduled Procedure Step Start Time	0040,0003	1
>Scheduled Procedure Step End Date	0040,0004	3
>Scheduled Procedure Step End Time	0040,0005	3
>Modality	0008,0060	1
>Scheduled Performing Physician Name	0040,0006	2
>Scheduled Procedure Step Description	0040,0007	1C
>Scheduled Station Name	0040,0010	2
>Scheduled Procedure Step Location	0040,0011	2
>Scheduled Protocol Code Sequence	0040,0008	1C
>>Code Value	0008,0100	1C
>>Coding Scheme Designator	0008,0102	1C
>>Coding Scheme Version	0008,0103	3
>>Code Meaning	0008,0104	3
>Pre-Medication	0040,0012	2C
>Scheduled Procedure Step ID	0040,0009	1
>Requested Contrast Agent	0032,1070	2C
>Scheduled Procedure Step Status	0040,0020	3
>Comments on the Scheduled Procedure Step	0040,0400	3
Requested Procedure ID	0040,1001	1
Requested Procedure Description	0032,1060	1C
Requested Procedure Code Sequence	0032,1064	1C
>Code Value	0008,0100	1C
>Coding Scheme Designator	0008,0102	1C
>Coding Scheme Version	0008,0103	3
>Code Meaning	0008,0104	3
Study Instance UID	0020,000D	1
Referenced Study Sequence	0008,1110	2
>Referenced SOP Class UID	0008,1150	1C
>Referenced SOP Instance UID	0008,1155	1C
Requested Procedure Priority	0040,1003	2
Patient Transport Arrangements	0040,1004	2
Reason For Requested Procedure	0040,1002	3
Requested Procedure Comments	0040,1400	3
Requested Procedure Location	0040,1005	3
Confidentiality Code	0040,1008	3
Reporting Priority	0040,1009	3
Names of Intended Recipients of Results	0040,1010	3
Accession Number	0008,0050	2
Requesting Physician	0032,1032	2
Referring Physician's Name	0008,0090	2
Reason for the Imaging Service Request	0040,2001	3
Imaging Service Request Comments	0040,2400	3
Requesting Service	0032,1033	3
Issuing Date of Imaging Service Request	0040,2004	3
Issuing Time of Imaging Service Request	0040,2005	3
Placer Order Number / Imaging Service Request	0040,2016	3
Filler Order Number / Imaging Service Request	0040,2017	3

Attribute Name	Tag	Type
Order Entered By …	0040,2008	3
Order Enterer's Location	0040,2009	3
Order Callback Phone Number	0040,2010	3
Admission ID	0038,0010	2
Issuer of Admission ID	0038,0011	3
Institution Name	0008,0080	3
Institution Address	0008,0081	3
Institution Code Sequence	0008,0082	3
>Code Value	0008,0100	3
>Coding Scheme Designator	0008,0102	3
>Coding Scheme Version	0008,0103	3
>Code Meaning	0008,0104	3
Current Patient Location	0038,0300	2
Visit Status ID	0038,0008	3
Patient's Institution Residence	0038,0400	3
Visit Comments	0038,4000	3
Referenced Patient Sequence	0008,1120	2
>Referenced SOP Class UID	0008,1150	2
>Referenced SOP Instance UID	0008,1155	2
Referring Physician's Address	0008,0092	3
Referring Physician's Phone Numbers	0008,0094	3
Admitting Diagnosis Description	0008,1080	3
Admitting Diagnosis Code Sequence	0008,1084	3
>Code Value	0008,0100	3
>Coding Scheme Designator	0008,0102	3
>Coding Scheme Version	0008,0103	3
>Code Meaning	0008,0104	3
Route of Admissions	0038,0016	3
Admitting Date	0038,0020	3
Admitting Time	0038,0021	3
Referenced Visit Sequence	0008,1125	3
>Referenced SOP Class UID	0008,1150	3
>Referenced SOP Instance UID	0008,1155	3
Referenced Patient Alias Sequence	0038,0004	3
>Referenced SOP Class UID	0008,1150	3
>Referenced SOP Instance UID	0008,1155	3
Patient Name	0010,0010	1
Patient ID	0010,0020	1
Issuer of Patient ID	0010,0021	3
Other Patient Ids	0010,1000	3
Other Patient Names	0010,1001	3
Patient's Birth Name	0010,1005	3
Patient's Mother's Birth Name	0010,1060	3
Medical Record Locator	0010,1090	3
Patient's Birth Date	0010,0030	2
Patient's Sex	0010,0040	2
Patient's Weight	0010,1030	2
Confidentiality Constraint on Patient Data	0040,3001	2
Patient's Age	0010,1010	3
Patient's Occupation	0010,2180	3
Patient's Birth Time	0010,0032	3
Patient's Insurance Plan Code Sequence	0010,0050	3
>Code Value	0008,0100	3
>Coding Scheme Designator	0008,0102	3
>Coding Scheme Version	0008,0103	3

E1E-BM5440

Attribute Name	Tag	Type
>Code Meaning	0008,0104	3
Patient's Size	0010,1020	3
Patient's Address	0010,1040	3
Military Rank	0010,1080	3
Branch of Service	0010,1081	3
Country of Residence	0010,2150	3
Region of Residence	0010,2152	3
Patient's Telephone Numbers	0010,2154	3
Ethnic Group	0010,2160	3
Patient's Religious Preference	0010,21F0	3
Patient Comments	0010,4000	3
Patient State	0038,0500	2
Pregnancy Status	0010,21C0	2
Medical Alerts	0010,2000	2
Contrast Allergies	0010,2110	2
Special Needs	0038,0050	2
Smoking Status	0010,21A0	3
Additional Patient History	0010,21B0	3
Last Menstrual Date	0010,21D0	3

Annex D

This annex details attributes for Modality Performed Procedure Step N-CREATE and N-SET request.

Table D-1 MPPS SOP Class N-CREATE, N-SET and Final State Attributes

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Req. Type Final State
Performed Procedure Step Relationship				
Scheduled Step Attribute Sequence	(0040,0270)	1/1	Not allowed	
>Study Instance UID	(0020,000D)	1/1	Not allowed	
>Referenced Study Sequence	(0008,1110)	2/2	Not allowed	
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Accession Number	(0008,0050)	2/2	Not allowed	
>Placer Order Number/Imaging Service Request	(0040,2016)	3/3	Not allowed	
>Filler Order Number/Imaging Service Request	(0040,2017)	3/3	Not allowed	
>Requested Procedure ID	(0040,1001)	2/2	Not allowed	
>Requested Procedure Description	(0032,1060)	2/2	Not allowed	
>Scheduled Procedure Step ID	(0040,0009)	2/2	Not allowed	
>Scheduled Procedure Step Description	(0040,0007)	2/2	Not allowed	
>Scheduled Protocol Code Sequence	(0040,0008)	2/2	Not allowed	
>>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Coding Scheme designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	Not allowed	
>>Coding Scheme Version	(0008,0103)	3/3	Not allowed	
>>Code Meaning	(0008,0104)	3/3	Not allowed	
Patient's Name	(0010,0010)	2/2	Not allowed	
Patient ID	(0010,0020)	2/2	Not allowed	
Patient's Birth Date	(0010,0030)	2/2	Not allowed	
Patient's Sex	(0010,0040)	2/2	Not allowed	
Referenced Patient Sequence	(0008,1120)	2/2	Not allowed	
>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	Not allowed	
>Referenced Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	Not allowed	
Performed Procedure Step Information				

Performed Procedure Step ID	(0040,0253)	1/1	Not allowed	
Performed Station AE Title	(0040,0241)	1/1	Not allowed	
Performed Station Name	(0040,0242)	2/2	Not allowed	
Performed Location	(0040,0243)	2/2	Not allowed	
Performed Procedure Step Start Date	(0040,0244)	1/1	Not allowed	
Performed Procedure Step Start Time	(0040,0245)	1/1	Not allowed	
Performed Procedure Step Status	(0040,0252)	1/1	3/1	
Performed Procedure Step Description	(0040,0254)	2/2	3/2	
Performed Procedure Type Description	(0040,0255)	2/2	3/2	
Procedure Code Sequence	(0008,1032)	2/2	3/2	
>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Version	(0008,0103)	3/3	3/3	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Procedure Step End Date	(0040,0250)	2/2	3/1	1
Performed Procedure Step End Time	(0040,0251)	2/2	3/1	1
Image Acquisition Results				
Modality	(0008,0060)	1/1	Not allowed	
Study ID	(0020,0010)	2/2	Not allowed	
Performed Protocol Code Sequence	(0040,0260)	2/2	3/2	
>Code Value	(0008,0100)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Coding Scheme Version	(0008,0103)	3/3	3/3	
>Code Meaning	(0008,0104)	3/3	3/3	
Performed Series Sequence	(0040,0340)	2/2	3/1	1
>Performing Physician's Name	(0008,1050)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Protocol Name	(0018,1030)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Operator's Name	(0008,1070)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Series Instance UID	(0020,000E)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	1
>Series Description	(0008,103E)	2C/2 (Required if	2C/2 (Required if	2

E1E-BM5440

		Sequence Item is present)	Sequence Item is present)	
>Retrieve AE Title	(0008,0054)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	2
>Referenced Image Sequence	(0008,1140)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	
>>Referenced SOP Class UID	(0008,1150)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C/1 (Required if Sequence Item is present)	1C/1 (Required if Sequence Item is present)	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C/2 (Required if Sequence Item is present)	2C/2 (Required if Sequence Item is present)	

Annex E

The following table specifies Modality Worklist return keys copied to MR Image IOD and/or MPPS IOD that are generated by the Hitachi MRI system.

Table E-1 MWL Return Keys Copied to MR Image IOD and MPPS IOD

Worklist		MR Image IOD		MPPS	
DICOM Tag	**Attribute Name**	**DICOM Tag**	**Attribute Name**	**DICOM Tag**	**Attribute Name**
(0008,0050)	Accession Number	(0008,0050)	Accession Number	(0008,0050)	Accession Number
(0008,0090)	Referring Physician's Name	(0008,0090)	Referring Physician's Name	-	-
(0010,0010)	Patient Name	(0010,0010)	Patient Name	(0010,0010)	Patient Name
(0010,0020)	Patient ID	(0010,0020)	Patient ID	(0010,0020)	Patient ID
(0010,0030)	Patient Birth Date	(0010,0030)	Patient Birth Date	(0010,0030)	Patient Birth Date
(0010,0040)	Patient Sex	(0010,0040)	Patient Sex	(0010,0040)	Patient Sex
(0010,1010)	Patient Age	(0010,1010)	Patient Age	-	-
(0010,1030)	Patient Weight	(0010,1030)	Patient Weight	-	-
(0010,4000)	Patient Comment	(0010,4000)	Patient Comment	-	-
(0020,000D)	Study Instance UID	(0020,000D)	Study Instance UID	(0020,000D)	Study Instance UID
(0032,1060)	Requested Procedure Description	(0008,1030)	Study Description	(0032,1060)	Requested Procedure Description
(0040,0002)	Scheduled Procedure Step Start Date	(0008,0020)	Study Date	-	-
(0040,0003)	Scheduled Procedure Step Start Time	(0008,0030)	Study Time	-	-
(0040,0006)	Scheduled Performing Physician Name	(0008,0015)	Performing Physicians	-	-
(0008,1110)	Referenced Study Sequence	-	-	(0008,1110)	Referenced Study Sequence
(0040,2016)	Placer Order Number / Imaging Service Request	-	-	(0040,2016)	Placer Order Number / Imaging Service Request
(0040,2017)	Filler Order Number / Imaging Service Request	-	-	(0040,2017)	Filler Order Number / Imaging Service Request
(0040,1001)	Requested Procedure ID	-	-	(0040,1001)	Requested Procedure ID
(0040,0009)	Scheduled Procedure Step ID	-	-	(0040,0009)	Scheduled Procedure Step ID
(0040,0007)	Scheduled Procedure Step Description	-	-	(0040,0007)	Scheduled Procedure Step Description
(0040,0008)	Scheduled Protocol Code Sequence	-	-	(0040,0008)	Scheduled Protocol Code Sequence
(0008,1120)	Referenced Patient Sequence	-	-	(0008,1120)	Referenced Patient Sequence