

MR Imaging System

Model AIRIS, MRP - 7000 Series, MRP - 5000AD

DICOM Conformance Statement

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Introduction

The following DICOM Conformance Statement adheres to the requirements of DICOM PS 3.2-1993 and is intended to be read by an audience familiar with the DICOM 3.0 standard for the MR Image Storage Class as specified in NEMA PS 3.3-1993 and NEMA PS 3.4-1993.

This DICOM Conformance Statement describes the implementation of the DICOM 3.0 (MEMA PS 3.X) standard as it applies to the Hitachi MR Image Export function of network capable models of the Hitachi MR scanner. It is intended to provide the reader with knowledge of the structure and manner of transmission of DICOM 3.0 conformant image information from the Hitachi MR scanner to a compatible DICOM 3.0 conformant remote application for the purposes of viewing and storage. This statement is not intended to provide the reader with detailed knowledge of the Hitachi MR Image Export application or of connectivity specifications outside the scope of the NEMA PS 3.X-1993 standard.

CONTENTS

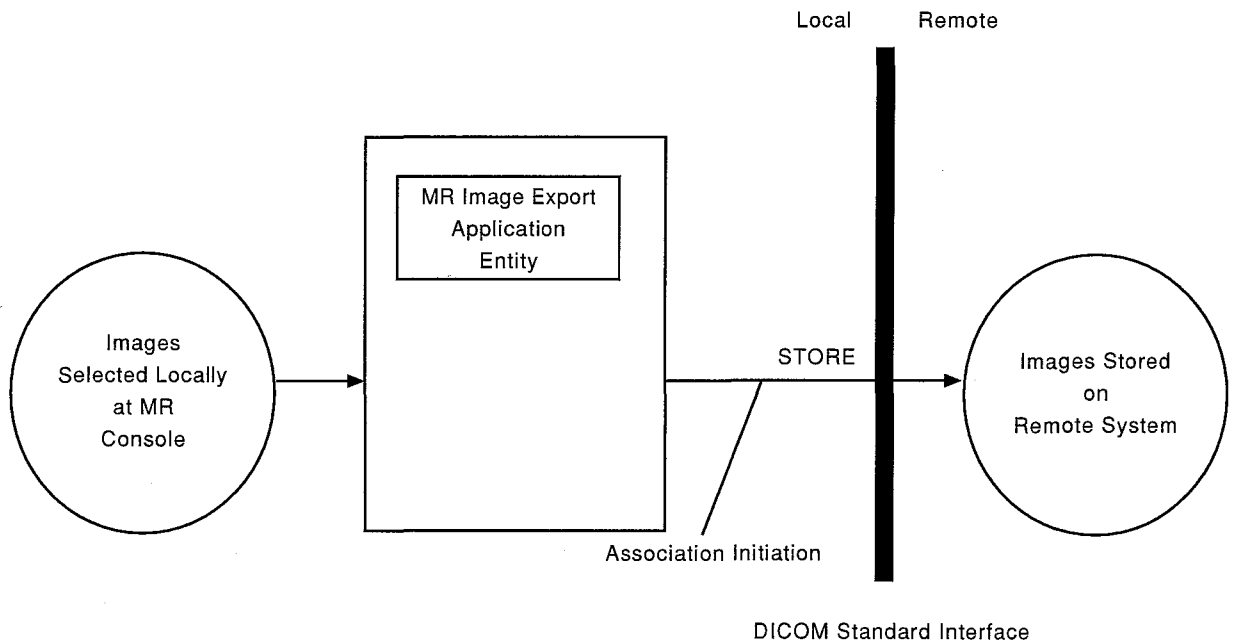
1.	Implementation model	3
1.1	Application data flow diagram	3
1.2	Functional definition of Application Entities (AE)	4
1.3	Sequencing of real-world activities	4
2.	AE specification	5
2.1	AE specification for Hitachi MR Export	5
3.	Communication profile	10
3.1	TCP/IP stack	10
4.	Extensions/specializations/privatizations	10
4.1	Standard extended/specialized/private SOPs	10
4.2	Private transfer syntaxes	10
4.3	Specialized conformance	10
5.	Configuration	11
5.1	AE title/presentation address mapping	12
5.2	Configurable parameters	12
6.	Support of extended character sets	12

1. Implementation model

The Hitachi MR (AIRIS, MRP-7000, MRP-5000AD) acts as a MR Image Storage Service Class User (SCU) to transfer image data to a remote MR Image Storage Service Class Provider (SCP).

1.1 Application data flow diagram

The Hitachi MR Image Export AE exports images for the purposes of viewing and storage on a remote system by requesting MR image storage services from a DICOM SCP over an association. The application initiates the association negotiation with a provider over the network when the MR console operator selects images to be transferred, selects a network destination, and activates the application. If the association is accepted by the provider, images are then transferred as separate Service Object Pair (SOP) Instances of the C-STORE service class from the diagnostic console to the storage provider over the association. When the transfer is completed, the Hitachi Image Export AE closes the association.



Application data flow diagram

1.2 Functional definition of Application Entities (AE)

The Hitachi MR Image Export AE assumes the role of SCU to create SOP instances of MR objects for transfer to a remote system over a network using the TCP/IP protocol stack and the DICOM transport protocol. When in transfer mode, the Hitachi MR Image Export AE initiates a request to send images to a predetermined DICOM-compliant image storage device. The AE retrieves an internally stored data set and converts it to a DICOM information object. The AE then transfers the object using the C-STORE-RQ Message over an open association.

1.3 Sequencing of real-world activities

Not applicable.

2. AE specification

2.1 AE specification for Hitachi MR Export

The Hitachi MR Export AE, in conjunction with MergeCOM-3, provides Standard Conformance to the following DICOM 3.0 SOP Class as an SCU.

SOP Class UID	SOP Class Name
1.2.840.10008.1.1	Verification SOP Class

The Hitachi MR Export AE provides Standard Conformance to the following DICOM 3.0 SOP Class as an SCU.

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.4	MRI Image Storage

2.1.1 Association establishment policies for Hitachi MR Export AE

(1) General

The maximum Protocol Data Unit (PDU) size is configurable from a minimum of 1,024 bytes to a maximum of 31,000 bytes. The PDU size proposed in an association request will default to 16,384 (16K) bytes unless otherwise configured.

(2) Number of associations

The Hitachi MR Export AE will open and maintain single associations. If a valid association is open it must first be closed before a new association can be opened.

(3) Asynchronous nature

The Hitachi MR Export AE does not support asynchronous communication (multiple outstanding transactions over a single association).

(4) Implementation identifying information

The Implementation Class Unique Identifier (UID) for the Hitachi MR Export AE is "1.2.392.200036.9123.100.12.10.yyyymmddhhmmss" where "yyymmddhhmmss" represents a fourteen character system distinguishing (serial) number. The model dependent Implementation Version Name is "HMC_MR_v.v" where 'n' is consistent with the model name and "v.v" reflects applicable MR software version.

2.1.2 Association initiation by Hitachi MR Export AE

The AE initiates an association under the following conditions.

1. The operator has requested a transfer of one or more images to a remote system and an open association does not exist.
2. The operator has requested a transfer of one or more images to a remote system and an open association exists but it must be closed before the transfer can occur.

An open association must be closed if the operator has requested a transfer to a remote system with a different Presentation Address and/or Application Entity Title than that for which the open association has been negotiated.

(1) Image Export real-world activity

(a) Associated real-world activity for Image Export

The operator requests a network transfer of one or more images by selecting a patient examination and destination via the diagnostic console user interface.

(b) Proposed presentation contexts for Image Export

The presentation contexts that will be proposed by the Hitachi MR Export AE for the Image Export real-world activity are specified in the following table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		
		DICOM Explicit VR Big Endian	1.2.840.10008.1.2.2		

(c) Specific conformance to MR Image Storage SOP Class If the Hitachi MR Export AE receives a successful C-STORE response status, the AE will issue the next C-STORE-RQ over the association if required. If a new association must be opened according to 2.1.2 above, the association will be closed, a new association will be opened, and a C-STORE-RQ will be issued. If C-STORE services are not requested within a configurable time period the association will be closed.

If the Hitachi MR Export AE receives a warning C-STORE response status, the AE will request the next C-STORE service over the association if required and will log a warning message to file. If a new association must be opened according to 2.1.2 above, the association will be closed, a new association will be opened, and a C-STORE-RQ will be issued.

If C-STORE services are not requested within a configurable time period the association will be closed.

If the Hitachi MR Export AE receives an unsuccessful C-STORE response status, the AE will abort the association and will log an error message to file. Extended negotiation is supported.

The following table lists the optional standard module which is present in the Information Object Definition(IOD) of standard MR objects created by the Hitachi MR Export AE.

Information Entity	Module
Image	VOL LUT

The following table lists the optional standard attributes which are present in the IOD of standard MR objects created by the Hitachi MR Export AE.

IE	Module	Optional Attribute	Tag
Equipment	General Equipment	Institution Name	0008,0080
		Manufacturer's Model Name	0008,1090
		Device Serial Number	0018,1000
		Software Version	0018,1020
Patient	Patient	Patient Name	0010,0010
		Patient ID	0010,0020
		Patient Birth Date	0010,0030
		Patient Sex	0010,0040
Study	General Study	Study Date	0008,0020
		Study Time	0008,0030
		Study Instance UID	0020,000D
		Study ID	0020,0010
		Study Description	0008,1030
Series	General Series	Modality	0008,0060
		Protocol	0018,1030
		Patient Position	0018,5100
		Series Instance UID	0020,000E
		Series Number	0020,0011
		Series Description	0008,103E
Frame of Reference	Frame of Reference	Frame of Reference UID	0020,0052

IE	Module	Optional Attribute	Tag
Image	General Image	Image Type	0008,0008
		Image Comments	0020,4000
		Image Number	0020,0013
		Patient Orientation	0020,0020
	Image Plane	Slice Location	0020,1041
		Slice Thickness	0018,0050
		Image Position(Patient)	0020,0032
		Image Orientation(Patient)	0020,0037
		Pixel Spacing	0028,0030
		Image Pixel	Samples per Pixel
	Photometric Interpretation		0028,0004
	Rows		0028,0010
	Columns		0028,0011
	Bits Allocated		0028,0100
	Bits Stored		0028,0101
	High Bit		0028,0102
	Pixel Representation		0028,0103
	Contrast/Blus	Contrast/Bolus Agent	0018,0010
		Contrast/Bolus Volume	0018,1041
	MR Image	Scanning Sequence	0018,0020
		Sequence Variant	0018,0021
		Scan Option	0018,0022
		MR Acquisition Type	0018,0023
		Angio Flag	0018,0025
		Repetition Time	0018,0080
		Echo Time	0018,0081
		Inversion Time	0018,0082
Number of Averages		0018,0083	
Imaging Frequency		0018,0084	
Imaged Nucleus		0018,0085	
Echo Number		0018,0086	
Magnetic Field Strength		0018,0087	
Echo Train Length		0018,0091	
Trigger Time		0018,1060	
Heart Rate		0018,1088	
Reconstruction Diameter		0018,1100	
Receiving Coil	0018,1250		
Acquisition Matrix	0018,1310		
Phase Encoding Direction	0018,1312		
Flip Angle	0018,1314		
VOI LUT	Window Center	0028,1050	
	Window Width	0028,1051	
SOP Common	Instance Creation Date	0008,0012	
	Instance Creation Time	0008,0013	
	Instance Creator UID	0008,0014	
	SOP Class UID	0008,0016	
	SOP Instance UID	0008,0018	

2.1.3 Association acceptance for Hitachi MR Export AE

This AE acts as an SCU and therefore does not accept associations.

3. Communication profile

3.1 TCP/IP stack

3.1.1 Physical Media Support

The Hitachi MR (AIRIS, MRP-7000 Series, MRP-5000AD) supports a single 10BASE5 Ethernet connection.

4. Extensions/specializations/privatizations

4.1 Standard extended/specialized/private SOPs

None supported.

4.2 Private transfer syntaxes

None supported.

4.3 Specialized conformance

4.3.1 Specialized SOP Class identification

None applicable.

4.3.2 Specialized Information Object Definition

The Standard MR Image Storage SOP Class is extended to a Standard Extended MR Image Storage SOP Class with the addition of a single Private Element.

The following table lists the optional extended module which is present in the IOD of extended MR objects created by the Hitachi MR Export AE.

Information Entity	Module
Image	Image ID

The following table lists the optional extended attributes which are present in the IOD of extended MR objects created by the Hitachi MR Export AE.

IE	Module	Extended Attribute	Tag
Image	Image ID	Private Creator	0009,0010
		Private Creator	0009,0011
		Private Creator	0009,0012
		Image ID Information	0009,1200

5. Configuration

The Hitachi MR Export AE is intended to be configured only by Hitachi service engineers. The application references four configuration files, the first of which it finds via the MERGE_INI environment variable. The configuration file list follows.

merge.ini	Specifies the paths of the other three configuration files. Specifies message logging parameters.
mergecom.pro	Specifies run-time parameters for the application.
mergecom.app	Defines service lists and applications on remote systems to which connections are possible.
mergecom.srv	Contains service class definitions.

5.1 AE title/presentation address mapping

Presentation address mapping is configured in the mergecom.app file. The Presentation Address of a remote SCP is specified by configuring the appropriate AE Title section of the file with the remote Listen Port and Host Name for each remote Application Entity to which a connection is possible.

The Host Name maps to an IP address as specified by the local host table. In general the well-defined Listen Port for a DICOM SCP is 104.

5.2 Configurable parameters

The mergecom.pro configuration file can be used to set or modify other lower-level communication parameters, such as maximum PDU size and timeout limits. Some information about supported SOP classes is also stored in this file.

Most parameters in this file should NEVER be changed. Doing so could break DICOM conformance. Before modifying any parameters, such as timeout, it is recommended that a backup be made of the originally supplied mergecom.pro file.

6. Support of extended character sets

Not supported.