2G985-035EN*C

DICOM CONFORMANCE STATEMENT

FOR

DATA MANAGEMENT SYSTEM

Abierto VNA

V1.2 SP0000J OR LATER

(HCBA-01)

CANON MEDICAL SYSTEMS CORPORATION

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1 CONFORMANCE STATEMENT OVERVIEW

HCBA-01 is a self-contained networked information system used for receiving, archiving and displaying of diagnostic medical images. The system conforms to the DICOM 3.0 standard to allow the sharing of medical information with other digital imaging systems.

Table 1.1-1
NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Basic Text SR	Yes	Yes
Breast Tomosynthesis Image Storage	Yes	Yes
Comprehensive SR	Yes	Yes
Computed Radiography Image Storage	Yes	Yes
CT Image Storage	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	Yes	Yes
Digital X-Ray Image Storage - For Presentation	Yes	Yes
Encapsulated PDF Storage	Yes	Yes
Enhanced CT Image Storage	Yes	Yes
Enhanced MR Image Storage	Yes	Yes
Enhanced SR	Yes	Yes
Enhanced US Volume Storage	Yes	Yes
Grayscale Softcopy Presentation State Storage	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage – For Presentation	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage – For Processing	Yes	Yes
Key Object Selection	Yes	Yes
Mammography CAD SR	Yes	Yes
MR Image Storage	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes
Nuclear Medicine Image Storage (Retired)	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes
RT Dose Storage	Yes	Yes

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
RT Image Storage	Yes	Yes
RT Plan Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
RT Treatment Summary Record Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Ultrasound Image Storage (Retired)	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes
VL Photographic Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes
X-Ray Radiation Dose SR	Yes	Yes
Study Root Q/R - FIND	Yes	Yes
Study Root Q/R - MOVE	Yes	Yes
Verification	Yes	Yes

2 Table of Contents

3 Introduction

3.1. Revision History

REV.	Date of Issue	Author	Description
	4-Jan-2018	Canon Medical Systems	Initial Version.
A	19-Jun-2018	Canon Medical Systems	Delete Patient Root.
B	16-Nov-2018	Canon Medical Systems	Add Used Port. Add Supported Character Set
C	24-Jun-2019	Canon Medical Systems	Change Application Data Flow Diagram

3.2. Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader is familiar with the terminology and concepts that are used in the DICOM 3.0 standard.

3.3. Remarks

DICOM by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first level validation for interoperability between different applications supporting the same DICOM functionality.
This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.
The scope of this Conformance Statement is to facilitate communication with HCBA-01 and other vendors' medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 standard. However, it is not guaranteed to ensure the desired interoperability and successful interconnectivity with existing DICOM systems.
The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity between HCBA-01 and other vendors' equipment.
- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM 3.0 standard will evolve to meet the users' future requirements. Canon Medical Systems reserves the right to make changes to its products or to discontinue its delivery.

3.4. Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard. Abbreviations and terms are as follows:

AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
GSDF	Grayscale Standard Display Function
GUI	Graphical User Interface
HIS/RIS	Hospital Information System / Radiology Information System
IOD	Information Object Definition
ISO	International Standard Organization
PDU	DICOM Protocol Data Unit

LUT	Look-up Table
P-LUT	Presentation Look-up Table
SCP	Service Class Provider
SCU	Service Class User
SOP	DICOM Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
TLS	Transport Layer Security
UID	Unique Identifier
VR	Value Representation

3.5. References

- [DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1- 3.21
- [IHE-TF] IHE Radiology Technical Framework, HIMSS/RSNA, Vol. I – IV
- [IHE-TF] IHE IT Infrastructure Technical Framework, HIMSS/RSNA, Vol. I – IV

4 Networking

4.1. Implementation Model

4.1.1. Application Data Flow

HCBA-01 is logically divided into different DICOM Application Entities: Storage Server, Query/Retrieve Server, Connect Server.

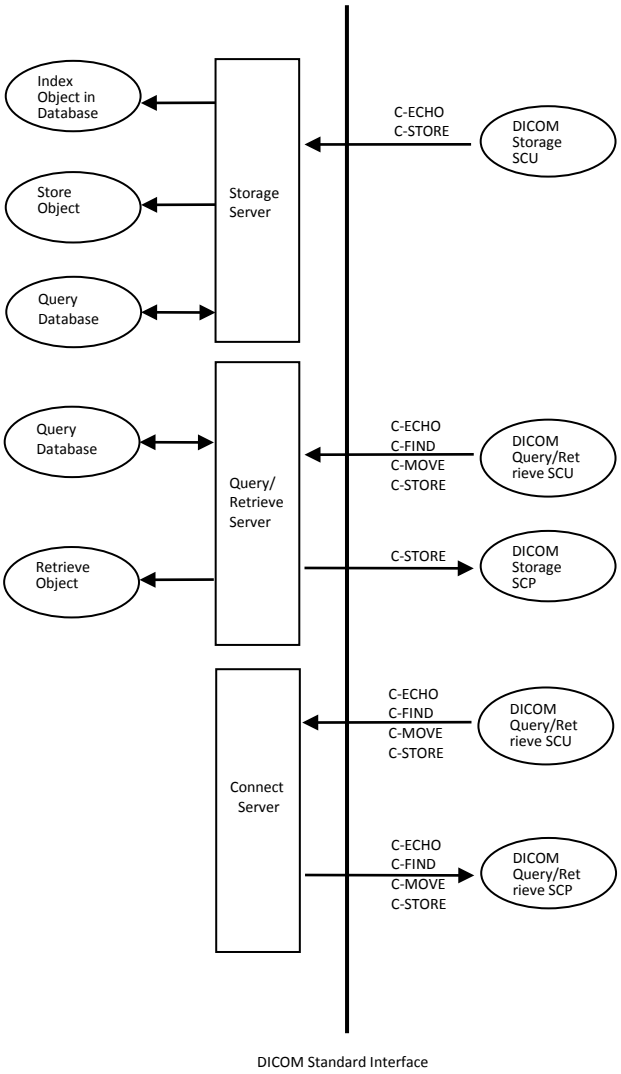

Figure 4.1-1
Application Data Flow Diagram

The Storage Server AE implements the DICOM Storage and Verification Service Class. This does not work by default and require additional configuration.
The Query/Retrieve Server AE implements the DICOM Storage, Query/Retrieve and Verification Service Class.
The Connect Server AE implements the DICOM Storage, Query/Retrieve and Verification Service Classes. The Connect Server AE can forward a request to another AE.

4.1.2. Functional Definitions of AEs

4.1.2.1. Functional Definition of HCBA-01 Storage Server AE

HCBA-01 Storage Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects,

the Storage Server AE expects it to be a DICOM application.
The Storage Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Storage Service Class.
Any objects received on such Presentation Contexts will be added to the Object Repository.
As part of regular maintenance activities, more specifically the synchronization of information that has been received by the Storage Server AE, the Storage Server AE will initiate a request to query for and retrieve objects from the AE that originally stored the object.
As part of regular maintenance activities, more specifically when HCBA-01 is configured as a cache, the Storage Server AE will initiate a request to store objects to one or more AEs that are serving as a long-term archive.

4.1.2.2. Functional Definition of HCBA-01 Query/Retrieve Server AE

HCBA-01 Query/Retrieve Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the Query/Retrieve Server AE expects it to be a DICOM application.
The HCBA-01 Query/Retrieve Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Query/Retrieve Service Class.
The HCBA-01 Query/Retrieve Server AE responds to queries based on the records stored in its database.
The HCBA-01 Query/Retrieve Server AE is used to query and retrieve DICOM objects that were stored to the Storage Server AE.

4.1.2.3. Functional Definition of Connect Server AE

HCBA-01 Connect Server Application Entity waits for another application to connect at the presentation address configured for its Application Entity Title When another application connects, the Connect Server AE expects it to be a DICOM application.
The Connect Server AE will accept Associations with Presentation Contexts for SOP Classes of the Verification and Query/Retrieve Service Classes.
The Connect Server AE responds to queries by proxying the Query/Retrieve requests to one or more AEs and providing the collated results to the original requesting AE.

4.2. AE Specifications

The following tables define default values that are referenced by the following sections.
The following Transfer Syntaxes are represented by the term [Default TS List]:

Table 4.2-1
Default TS List

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

The following Transfer Syntaxes are represented by the term [Extended TS List]:

Table 4.2-2
Extended TS List

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

Name List	UID List
JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Lossless, Non- Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless Image Compression	1.2.840.10008.1.2.4.90

The following SOP Classes are represented by the term [Default SOP Class List]:

Table 4.2-3
Default SOP Class List

Name List	UID List	Transfer Syntax
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Table 4.2-2 Extended TS List
Digital Mammography X-Ray Image Storage	1.2.840.10008.5.1.4.1.1.1.2	Table 4.2-2 Extended TS List
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Table 4.2-2 Extended TS List
Digital Intra-Oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Table 4.2-2 Extended TS List
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Table 4.2-2 Extended TS List
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Table 4.2-2 Extended TS List
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Table 4.2-2 Extended TS List
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Table 4.2-2 Extended TS List
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Table 4.2-2 Extended TS List
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Table 4.2-2 Extended TS List
Nuclear Medicine Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.5	Table 4.2-2 Extended TS List
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Table 4.2-2 Extended TS List
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Table 4.2-2 Extended TS List
Enhanced US Volume Storage	1.2.840.10008.5.1.4.1.1.6.2	Table 4.2-2 Extended TS List
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Table 4.2-2 Extended TS List
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	Table 4.2-2 Extended TS List
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	Table 4.2-1 Default TS List
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Table 4.2-2 Extended TS List

X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	Table 4.2-2 Extended TS List
Breast Tomosynthesis Image Storage	1.2.840.10008.5.1.4.1.1.13.1.3	Table 4.2-2 Extended TS List
Intravascular Optical Coherence Tomography Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.14.1	Table 4.2-2 Extended TS List
Intravascular Optical Coherence Tomography Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.14.2	Table 4.2-2 Extended TS List
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Table 4.2-2 Extended TS List
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	Table 4.2-2 Extended TS List
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Table 4.2-2 Extended TS List
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11	Table 4.2-1 Default TS List
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	Table 4.2-1 Default TS List
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Table 4.2-1 Default TS List
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Table 4.2-1 Default TS List
Key Object Selection	1.2.840.10008.5.1.4.1.1.88.59	Table 4.2-1 Default TS List
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Table 4.2-1 Default TS List
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	Table 4.2-1 Default TS List
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Table 4.2-2 Extended TS List
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Table 4.2-2 Extended TS List
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Table 4.2-1 Default TS List
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Table 4.2-1 Default TS List
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Table 4.2-1 Default TS List
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Table 4.2-1 Default TS List
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Table 4.2-1 Default TS List
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Table 4.2-1 Default TS List

HCBA-01 store without processing the structure that received as SCP.

4.2.1. HCBA-01 Storage Server AE Specification

4.2.1.1. SOP Classes

HCBA-01 Storage Server Application Entity provides Standard Conformance to the following SOP Classes:

Table 4.2-4
SOP Classes for HCBA-01 Storage Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes
Table 4.2-3 Default SOP Class List		No	Yes

4.2.1.2. Association Establishment Policy

4.2.1.2.1. General

The HCBA-01 Storage Server AE can accept Association Requests. The HCBA-01 Storage Server AE will accept Association Requests for the Verification, Storage Services.
The DICOM standard application context name for DICOM 3.0 is always accepted:

Table 4.2-5
DICOM application context name for HCBA-01 Storage Server AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2. Number of Associations

HCBA-01 Storage Server can support multiple simultaneous Associations requested by peer AEs. Default is 10.

Table 4.2-6
Number of Associations accepted by HCBA-01 Storage Server AE

Maximum number of simultaneous Associations	10

4.2.1.2.3. Asynchronous Nature

HCBA-01 Storage Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous).

Table 4.2-7
Asynchronous Nature as SCP for HCBA-01 Storage Server AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

4.2.1.2.4. Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-8
DICOM Implementation Class and Version for HCBA-01 Storage Server AE

Implementation Class UID	2.16.124.113638.2
Implementation Version Name	rialto-dcm4che2

4.2.1.3. Association Acceptance Policy

4.2.1.3.1. Activity - Receive Images

Description and Sequencing of Activities

A remote peer DICOM Application Entity, acting as a Storage SCU, establishes an association with HCBA-01 Storage Server that accepts these Associations for the purpose of receiving supported SOP Class Instances requests.

In the default configuration any Calling and Called AET will be accepted. If the Called AET does not correspond to the actual Storage Server AET, only a Presentation Context for the Verification SOP Class will be accepted and the SCU can only verify the DICOM Association, but cannot invoke any other related DICOM service.

The Storage Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason / Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU.

Table 4.2-9
Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 - rejected permanent	user	3 – calling AE title not recognized	The Association request contained an unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

HCBA-01 Storage Server AE will accept Presentation Contexts as shown in the following table:

Table 4.2-10
Accepted Presentation Contexts for HCBA-01 Storage Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Verification SOP Class	1.2.840.10008.1.1	Table 4.2-1 Default TS List	SCP	None
Table 4.2-3 Default SOP Class List			SCP	None

The preferred (default) Transfer Syntax is Explicit VR Little Endian.

SOP Specific Conformance

Specific Conformance for the Verification SOP Class

HCBA-01 Storage Server provides standard conformance to the DICOM Verification Service Class as an SCP. The status code for the C-ECHO is described in the following table:

Table 4.2-11
HCBA-01 Storage Server C-Echo Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The C-ECHO request is accepted

Specific Conformance for the Storage SOP Classes

The associated activity with the Storage service is the storage of DICOM data received over the network on a designated storage repository. The HCBA-01 Storage Server AE will return a failure status if it is unable to store the received instance(s).

The HCBA-01 Storage Server AE does not have any dependencies on the number of Associations used to send images to it. Images belonging to more than one Study or Series can be sent over a single or multiple Associations. Images belonging to a single Study or Series can also be sent over different Associations. There is no limit on either the number of SOP Instances or the maximum amount of total SOP Instance data that can be transferred over a single Association.
The HCBA-01 Storage Server AE always retains the original DICOM data in DICOM Part 10 compliant file format, which is stored in the local storage system. The HCBA-01 Storage Server AE is Level 2 (Full) conformant as a Storage SCP. In addition, all Private and SOP Class Extended Elements are maintained in the DICOM format files. In addition to saving all Elements in files, a subset of the Elements is stored in the HCBA-01 Storage Server database to support query and retrieval requests.

Storage Server AE C-STORE Response

Table 4.2-12
HCBA-01 Storage Server C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the system repository.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response from the HCBA-01 database or a file system operation.
			The appropriate Status will be sent in the C-STORE Response.
			Error indication message is output to the Service Log.
Error	Duplicate SOP Instance UID	D000	This status is returned if the instance already exists in the database and the HCBA-01 Storage Server AE is configured to refuse duplicate instances.
			The appropriate Status will be sent in the C-STORE Response.
			Error indication message is output to the Service Log.
Warning	Data Set does not match SOP class	B007	This status is returned if the C-STORE Request specifies Attributes that are not specific as part of the Storage SOP class.
			Image transmission is considered successful. The appropriate SUCCESS Status will be sent in the C-STORE Response.
			Warning indication message is output to the Service Log.

Table 4.2-13
HCBA-01 Storage Server Service Communication Failure Behavior

Exception	Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. The Storage Server SCP AE is waiting for the next C-STORE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received, they are maintained in the database. They are not automatically discarded because of a later failure. Error message is output to the Service Log.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The Storage Server SCP AE is waiting for the next C-STORE Data Set PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log. If a C-STORE Data Set has not been fully received, the data already received is discarded. If some Composite SOP Instances have already been successfully received over the Association, they are maintained in the database. Error message is output to the Service Log.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log. If some Composite SOP Instances have already been successfully received, they are maintained in the database. They are not automatically discarded because of a later failure.

4.2.2. HCBA-01 Query/Retrieve Server AE Specification

4.2.2.1. SOP Classes

HCBA-01 Query/Retrieve Server Application Entity provides Standard Conformance to the following SOP Classes:

Table 4.2-14
SOP Classes for HCBA-01 Query/Retrieve Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	No	Yes
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	No	Yes
Table 4.2-3 Default SOP Class List		Yes	Yes

4.2.2.2. Association Establishment Policy

4.2.2.2.1. General

The HCBA-01 Query/Retrieve Server AE can both accept and propose Association Requests. The HCBA-01 Query/Retrieve Server AE will accept Association Requests for the Verification and Query/Retrieve Services. It will propose Associations for Verification and Storage Services.
The DICOM standard application context name for DICOM 3.0 is always accepted and proposed:

Table 4.2-15
DICOM application context name for HCBA-01 Query/Retrieve Server AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2. Number of Associations

HCBA-01 Query/Retrieve Server can support multiple simultaneous Associations requested by peer AEs. Default is 10. This value can be configured through the attribute "MaxClients" in the Application Server configuration.

Table 4.2-16
Number of Associations accepted for HCBA-01 Query/Retrieve Server AE

Maximum number of simultaneous Associations	10

4.2.2.2.3. Asynchronous Nature

HCBA-01 Query/Retrieve Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous).

Table 4.2-17
Asynchronous Nature as SCP for HCBA-01 Query/Retrieve Server AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

4.2.2.2.4. Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-18
DICOM Implementation Class and Version for HCBA-01 Query/Retrieve Server AE

Implementation Class UID	2.16.124.113638.2
Implementation Version Name	rialto-dcm4che2

4.2.2.3. Association Initiation Policy

4.2.2.3.1. Activity - Send Images Requested by an External Peer AE

Description and Sequencing of Activities

The HCBA-01 Query/Retrieve AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer. The Query/Retrieve AE will send the Association Request to the specific C-MOVE destination, and upon successful negotiation of the required Presentation Context the image transfer is started. In all cases an attempt will be made to transmit all the indicated images in a single Association but this may not always be possible. The Association will be released when all the images have been sent.
If an error occurs during transmission over an open Association, the image transfer is halted. The Query/Retrieve AE will not attempt to independently retry the image export.
By default, the HCBA-01 Query/Retrieve Server AE will not transcode information from one transfer syntax to another when sending images to the specific C-MOVE destination. If the specific C-MOVE destination does not support the transfer syntax that the image was stored in, the HCBA-01 Query/Retrieve Server AE will re-initiate the Association by uncompressed transfer syntax and send images.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].

HCBA-01 Query/Retrieve AE will propose Presentation Contexts as shown in the following table:

Table 4.2-19
Proposed Presentation Contexts by the HCBA-01 Query/Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Table 4.2-3 Default SOP Class List			SCU	None

SOP Specific Conformance
Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

Specific Conformance for Image, SR and KIN SOP Classes

The Query/Retrieve Server AE will exhibit the following behavior according to the Status Code value returned in a C-STORE Response from a destination C-STORE SCP:

Table 4.2-20
HCBA-01 Query/Retrieve Server AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The remote Storage SCP has successfully stored the exported SOP Instance. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Refused	Out of Resources	A700 – A7FF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Error	Cannot Understand	C000 – CFFF	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Warning indication message is output to the Service Logs.
Warning	Elements Discarded	B006	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute List Error	0107	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
Warning	Attribute Value Out of Range	0116	Image transmission is considered successful. The appropriate PENDING or SUCCESS Status will be sent in the C-MOVE Response. Success indication message is output to the Service Log.
*	*	Any other status code	This is treated as a permanent Failure. The appropriate Status will be sent in the C-MOVE Response. Error indication message is output to the Service Log.

Table 4.2-21
HCBA-01 Query/Retrieve Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs.

Exception	Behavior
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the CMOVE Response. Error indication message is output to the Service Logs.

4.2.2.3.2. Activity - Retrieve Images Requested by an External Peer AE

Description and Sequencing of Activities

The HCBA-01 Query/Retrieve AE will initiate a new Association when a valid C-MOVE Request has been performed by an external Peer but one or more of the requested objects is not found in local storage. The Query/Retrieve AE will send an Association Request to the AE that originally stored the objects, and upon successful negotiation of the required Presentation Context a retrieve request is started. The Association will be released when all the images have been sent.

Proposed Presentation Contexts

A list of Transfer Syntaxes can be configured for each AET. The default Transfer Syntaxes are the Transfer Syntax of the originally received instance plus the [Default TS List].
The following Transfer Syntaxes are represented by the term [Default TS List]:

Table 4.2-22
Transfer Syntax List for HCBA-01 Query/Retrieve Server AE

Name List	UID List
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Little Endian	1.2.840.10008.1.2.1

HCBA-01 Query/Retrieve AE will propose Presentation Contexts as shown in the following table:

Table 4.2-23
Proposed Presentation Contexts by the HCBA-01 Query/Retrieve Server AE

Abstract Syntax		Transfer Syntax	Role	Ext. Neg.
Name	UID			
Table 4.2-3 Default SOP Class List			SCU	None

SOP Specific Conformance
Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

4.2.2.4. Association Acceptance Policy

4.2.2.4.1. Activity - Handling Query and Retrieval Requests

Description and Sequencing of Activities

The Query/Retrieve Server AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, the Association Request itself is rejected. It can be configured to only accept Associations from certain Application Entities.
If Query/Retrieve Server AE receives a query (C-FIND) request, the response(s) will be sent over the same Association used to receive the C-FIND-Request.
If Query/Retrieve Server AE receives a retrieval (C-MOVE) request, the responses will be sent over the same Association used to receive the C-MOVE-Request.
The Query/Retrieve Server AE will send the requested SOP Instances to the C-MOVE Destination over a newly created Association and report in the C-MOVE-Response any success

or failure status of each attempt to send a Composite SOP Instance.
The Query/Retrieve Server AE may reject Association attempts as shown in the table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU.

Table 4.2-24
Association Rejection Reasons

Result	Source	Reason / Diag	Description
2 - rejected transient	provider	2 - local-limit exceeded	The (configurable) maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
1 - rejected permanent	user	2 - application context name not supported	The Association request contained an unsupported Application Context Name. An association request with the same parameters will NOT succeed at a later time.
1 - rejected permanent	user	3 – calling AE title not recognized	The Association request contained an unrecognized Calling AE Title. An association request with the same parameters will NOT succeed at a later time unless configuration changes are made.

Accepted Presentation Contexts

HCBA-01 Query/Retrieve Server AE will accept Presentation Contexts as shown in the following table:

Table 4.2-25
Accepted Presentation Contexts for HCBA-01 Query/Retrieve Server AE

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information 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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Study Root Q/R Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Relational
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

If the Called AET is not corresponding to the actual Query/Retrieve Server AET, only the Presentation Context for the Verification SOP Class will be accepted.

SOP Specific Conformance
Specific Conformance for Verification SOP Class

HCBA-01 Query/Retrieve Server provides standard conformance to the DICOM Verification Service Class as an SCP. The status code for the C-ECHO is described in the following table:

Table 4.2-26
HCBA-01 Query/Retrieve Server C-Echo Response Status

Service Status	Further Meaning	Error Code	Reason

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The C-ECHO request is accepted

Specific Conformance for Query SOP Class

The Query/Retrieve Server AE supports hierarchical queries and not relational queries. There are no attributes, which are always returned by default. Only those attributes requested in the query identifier are returned.
Query responses always return values from the Query/Retrieve Server database. Exported SOP Instances are always updated with the latest values kept in the database prior to export. Thus, a change in Patient demographic information will be contained in both the C-FIND Responses and any Composite SOP Instances exported to a C-MOVE Destination AE.
If no Issuer of Patient ID and Issuer of Patient ID Qualifiers Sequence is present, default configurable values are assumed.

Study Root Information Model

All the required search keys on the Study level are supported.

Table 4.2-27
Study Root C-FIND SCP Supported Elements

SOP Common - Attribute Name	Tag	VR	Types of Matching
Specific Character Set	0008,0005	CS	NONE
Instance Availability	0008,0056	CS	S,U
Study Level - Attribute Name	**Tag**	**VR**	**Types of Matching**
Patient's Name	0010,0010	PN	S,W,U
Patient ID	0010,0020	LO	S,W,U
Issuer of Patient ID	0010,0021	LO	S,U
Issuer of Patient ID Qualifiers Sequence	0010,0024	SQ	S,U
>Universal Entity ID	0040,0032	UT	S
>University Entity ID Type	0040,0033	CS	S
Other Patient IDs Sequence	0010,1002	SQ	U
Patient's Birth Date	0010,0030	DA	S,U,R
Patient’s Birth Time	0010,0032	TM	S,U,R
Patient's Sex	0010,0040	CS	S,U
Study Instance UID	0020,000D	UI	S,L,U
Study ID	0020,0010	SH	S,W,U
Study Date	0008,0020	DA	S,U,R
Study Time	0008,0030	TM	S,U,R
Accession Number	0008,0050	SH	S,W,U
Modalities In Study	0008,0061	CS	U
Study Description	0008,1030	LO	U
Referring Physician’s Name	0008,0090	PN	U

Institution Name	0008,0080	LO	S,W,U
Procedure Code Sequence	0008,1032	SQ	S,U
Number of Study Related Series	0020,1206	IS	U
Number of Study Related Instances	0020,1208	IS	U
SOP Classes in Study	0008,0062	UI	U
Series Level - Attribute Name	**Tag**	**VR**	**Types of Matching**
Series Instance UID	0020,000E	UI	S,U
Modality	0008,0060	CS	S,U
Series Date	0008,0021	DA	S,R,U
Series Time	0008,0031	TM	S,R,U
Series Description	0008,103E	LO	S,W,U
Laterality	0020,0060	CS	S,U
Anatomic Region Sequence	0008,2218	SQ	U
Body Part Examined	0018,0015	CS	S,W,U
Manufacturer	0008,0070	LO	S,W,U
Manufacturer's Model Name	0008,1090	LO	S,W,U
Frame of Reference UID	0020,0052	UI	S,U
Performed Procedure Step Description	0040,0254	LO	S,W,U
Protocol Name	0018,1030	LO	S,W,U
Station Name	0008,1010	SH	S,W,U
Institutional Department Name	0008,1040	LO	S,W,U
Performing Physician's Name	0008,1050	PN	S,W,U
Performed Procedure Step Start Date	0040,0244	DA	S,R,U
Performed Procedure Step Start Time	0040,0245	TM	S,R,U
Corrected Image	0028,0051	LO	S,W,U
Date of Last Calibration	0018,1200	DA	U
Device Serial Number	0018,1000	LO	S,U
Institution Address	0008,0081	ST	S,U
Institutional Department Name	0008,1040	LO	S,W,U
Institution Name	0008,0080	LO	S,W,U
Operators' Name	0008,1070	PN	S,W,U
Performed Procedure Step Status	0040,0252	CS	S,W,U
Pixel Padding Value	0028,0120	US or SS	S,U
Presentation Intent Type	0008,0068	CS	S,W,U

Series Number	0020,0011	IS	S,U
Series Type	0054,1000	CS	S,W,U
Smallest Pixel Value In Series	0028,0108	US or SS	U
Software Version(s)	0018,1020	LO	S,W,U
Spatial Resolution	0018,1050	DS	S,W,U
Station Name	0008,1010	SH	S,W,U
Date of Last Calibration	0018,1200	DA	S,R,U
Time of Last Calibration	0018,1201	TM	S,R,U
Number of Series Related Instances	0020,1209	IS	U
SOP Level - Attribute Name	**Tag**	**VR**	**Types of Matching**
SOP Instance UID	0008,0018	UI	S,L,U
SOP Class UID	0008,0016	UI	S,U
Rows	0028,0010	US	S,U
Columns	0028,0011	US	S,U
Number of Frames	0028,0008	IS	S,U
Bits Allocated	0028,0100	US	S,U
Content Date	0008,0023	DA	S,R,U
Content Time	0008,0033	TM	S,R,U
Observation Date Time	0040,A032	DT	S,U
Concept Name Code Sequence	0040,A043	SQ	S,U
Content Label	0070,0080	CS	S,W,U
Content Description	0070,0081	LO	S,W,U
Presentation Creation Date	0070,0082	DA	S,R,U
Presentation Creation Time	0070,0083	TM	S,R,U
Content Creator’s Name	0070,0084	PN	S,W,U
Transfer Syntax UID	0002,0010	UI	S,U
Requested Procedure ID	0040,1001	SH	S,U

Types of Matching:

The types of Matching supported by the C-FIND SCP. An "S" indicates the identifier attribute uses Single Value Matching, an “R” indicates Range Matching, a “W” indicates wildcard matching, a ‘U’ indicates Universal Matching (i.e. return keys), and an ‘L’ indicates that UID lists are supported for matching.

Table 4.2-28
HCBA-01 Query/Retrieve Server C-FIND Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	Matching is complete. No final identifier is supplied.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response on a query of the HCBA-01 database. The appropriate Status will be sent in the C-FIND Response. Error indication message is output to the Service Log.
Cancel	Matching terminated due to Cancel Request	FE00	The C-FIND SCU sent a Cancel Request. This has been acknowledged and the search for matches has been halted. Cancel indication message is output to the Service Log.
Pending	Matches are continuing and current match is supplied	FF00	Indicates that the search for further matches is continuing. This is returned when each successful match is returned and when further matches are forthcoming. Pending indication message is output to the Service Log.

Specific Conformance for Retrieve SOP Class

The Query/Retrieve Server AE supports hierarchical and relational retrieves.
Exported SOP Instances are always updated with the latest values kept in the database prior to export.

Table 4.2-29
HCBA-01 Query/Retrieve Server C-MOVE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	Matching is complete. No final identifier is supplied.
Error	Processing Failure	0110	This status is returned due to internal errors such as a processing failure response on a query of the HCBA-01 database. Error indication message is output to the Service Log. The appropriate Status will be sent in the C-MOVE Response.
Error	Unable to perform sub-operations	A702	C-STORE sub-operations cannot be performed due to failure of an Association Request or a C-STORE Request. Error indication message is output to the Service Log.
Error	Move Destination unknown	A801	The Destination Application Entity named in the C-MOVE Request is unknown to Query/Retrieve SCP AE. Error indication message is output to the Service Log.
Error	Identifier does not match SOP Class	A900	The C-MOVE identifier contains invalid Elements or values, or is missing mandatory Elements or values for the specified SOP Class or retrieval level. Error indication message is output to the Service Log.
Error	Unable to process	Cxxx	The Move Destination AET is missing in the C-MOVE Request. Error indication message is output to the Service Log.
Pending	Sub-operations are continuing	FF00	A Response with this Status Code is sent every time a Composite SOP Instance has been successfully sent to the C-MOVE Destination AE.

Table 4.2-30
HCBA-01 Query/Retrieve Server Service Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout). I.e. the Query/Retrieve Server SCP AE is waiting for the next C-FIND or C-MOVE Request on an open Association but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout). I.e. The Query/Retrieve Server AE is waiting for the next message PDU but the timer expires.	The Association is aborted by issuing a DICOM A-ABORT. Error message is output to the Service Log.
Association aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error message is output to the Service Log.

4.2.3. HCBA-01 Connect Server AE Specification

4.2.3.1. SOP Classes

HCBA-01 Connect Server Application Entity provides Standard Conformance to the following SOP Classes:

Table 4.2-31
SOP Classes for HCBA-01 Connect Server AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Study Root Q/R Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Study Root Q/R Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Table 4.2-3 Default SOP Class List		Yes	Yes

4.2.3.2. Association Establishment Policy

4.2.3.2.1. General

The HCBA-01 Connect Server AE can propose Association Requests. The HCBA-01 Connect Server AE will accept Association Requests for the Verification and Query/Retrieve Services. It will propose Associations for Verification and Query/Retrieve Services.
The DICOM standard application context name for DICOM 3.0 is always proposed:

Table 4.2-32
DICOM application context name for HCBA-01 Connect Server AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2. Asynchronous Nature

The HCBA-01 Connect Server does not support asynchronous communication. Multiple outstanding transactions are not supported. It allows up to one invoked and one performed operation on an Association (it is synchronous).

Table 4.2-33
Asynchronous Nature as SCP for HCBA-01 Connect Server AE

Maximum number of outstanding asynchronous transactions	1 (Not Configurable)

4.2.3.2.3. Implementation Identifying Information

The implementation information for this Application Entity is:

Table 4.2-34
DICOM Implementation Class and Version for HCBA-01 Connect Server AE

Implementation Class UID	2.16.124.113638.2
Implementation Version Name	rialto-dcm4che2

4.2.3.3. Association Initiation Policy

4.2.3.3.1. Activity – Query/Retrieve Requested by an External Peer AE

Description and Sequencing of Activities

The HCBA-01 Connect AE will send the Association Request one or more C-FIND or C-MOVE destination, and upon successful negotiation of the required Presentation Context original C-FIND or C-

MOVE request will be forwarded on the new Association. The Association will be released when all the C-FIND or C-MOVE responses have been received.

Table 4.2-35
HCBA-01 Connect Server AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Request (DIMSE level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the C-FIND or C-MOVE Response. Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/ IP packet (Low-level timeout).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the C-FIND or C-MOVE Response. Error indication message is output to the Service Logs.
Association A-ABORTed by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure).	The Association is aborted by issuing a DICOM A-ABORT. The appropriate Status will be sent in the C-FIND or C-MOVE Response. Error indication message is output to the Service Logs.

4.2.3.4. Association Acceptance Policy

4.2.3.4.1. Activity - Handling Query and Retrieval Requests

Description and Sequencing of Activities

The Connect Server AE will forward the query or retrieval request to a newly created Association and report in the C-FIND or C-MOVE-Response any success or failure status of each forwarded request.

Specific Conformance for Query SOP Classes

The Connect Server forwards query requests without modification.

Specific Conformance for Retrieve SOP Classes

The Connect Server forwards retrieve requests without modification.

4.3. Network Interfaces

4.3.1. Physical Network Interface

HCBA-01 is indifferent to the physical medium over which TCP/IP executes because this works on virtual environment.

4.3.2. Additional Protocols

HCBA-01 conforms to the System Management Profiles listed in Table 4.3-1.

Table 4.3-1
SUPPORTED SYSTEM MANAGEMENT PROFILES

Profile Name	Actor	Protocol	Support
Network Address Management	DHCP Client	DHCP	No
	DNS Client	DNS	Yes
Time Synchronization	NTP Client	NTP	Yes
	DHCP Client	DHCP	No
DICOM Application Configuration Management	LDAP Client	LDAP	No

4.3.3. IPv4 and IPv6 Support

HCBA-01 only supports IPv4 connections.

4.4. Configuration

4.4.1. AE Title/Presentation Address Mapping

4.4.1.1. Local AE Titles

The local AE Titles and TCP ports are configurable through the HCBA-01 configuration interface.

Table 4.4-1
AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
HCBA-01 Storage Server	ABIERTO_VNA	11113
HCBA-01 Query/Retrieve Server	ABIERTO_VNA	11112
HCBA-01 Connect Server	CONNECT	4109

4.4.1.2. Remote AE Titles

Remote AE Titles, TCP/IP Addresses and ports can be configured through the HCBA-01 configuration interface. In the default configuration, Association Requests with any Calling AET will be accepted.

4.4.2. Configuration Parameters

The following table shows the HCBA-01 configuration parameters relevant to DICOM communication.

Table 4.4-2
Configuration Parameter Table

Parameter	Configurable (Yes/No)	Default Value
General		
Maximum number of simultaneous Associations	No	10
Time-out waiting for A-ASSOCIATE RQ on open TCP/IP connection (ARTIM timeout)	No	5s
Time-out waiting on an open association for the next message (DIMSE timeout)	No	1h
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout)	No	no timeout
Time-out waiting on an open association for the next message after sending A-RELEASE RSP or A-ABORT RQ (Closing timeout)	No	500ms
Maximum PDU size the AE can receive	No	16352
Maximum PDU size the AE can send	No	65535
Pack Command and Data PDVs in one PDU	No	FALSE
Support for the Basic TLS Secure Transport Connection Profile	No	off
Accepted TLS Ciphers	No	-

5 Media Interchange

HCBA-01 does not support Media Storage.

6 Support of Extended Character Sets

HCBA-01 supports ISO-IR 6 and IR 87 as an extended character set.

7 Security

7.1. Security Profiles

This product does not support any specific security measures.

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

7.2. Association Level Security

HCBA-01 can be configured to accept Association Requests from only a limited list of Calling AE Titles.
In the default configuration, Association requests with any Calling AET and any Called AET will be accepted. However, if the Called AET is not corresponding to any of the actual DICOM server AETs, only acceptance of the Presentation Context for Verification SOP Class will be returned in the Association Acceptance Response (A-ASSOCIATE AC).

7.3. Application Level Security

The HCBA-01 web based administration module can be configured to require user authentication in order to access the user interface functionalities.