



KONICA MINOLTA

Ultra

DICOM

Conformance Statement

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REVISION HISTORY

Rev.	DCN No.	Description of Change
A	17-22	Initial release.
A	DCN-000195	Initial release with new Arena document number scheme. Updated DICOM Conformance statement to include DDR dose reporting and minor formatting.
B	DCN-000255	Updated DICOM Conformance statement to include DDR dose reporting and minor formatting
C	DCN-000347	Updated Table 1: Supported SCU SOP classes to include SOP class for X-Ray Radiation Dose SR
D	DCN-000390	Images requested for storage by ULTRA will include Filter DICOM tags.
E	DCN-000543	Correction to table where Storage Service should drop "Commitment" term and DICOM C-Echo added to list.
F	DCN-000576	Updated DICOM Conformance statement to include the addition of certain DICOM tags with 5.1.5.0 Patch Release
G	DCN-000732	Included DICOM tags used when sending image data to IWS. Added explanation of how Ultra generates Study Instance UID. Added the Instance Creator UID tag. Updated the values for Implementation Class UID and Implementation Version Name.
H	DCN-000820	Specified Ultra support of Specific Character Set DICOM tag for MWL data.

All information contained in this document is accurate to the best knowledge of Konica Minolta Healthcare Americas, as of date of publication and is subject to change without notice. This document is only a statement of conformance to the DICOM standard and in no way represents any other specifications of the associated product.

1.0 INTRODUCTION

1.1 Purpose of this Document

This document is the DICOM Conformance Statement for ULTRA products. The purpose of this document is to describe how ULTRA products interact with other DICOM devices on the network.

1.2 Sources for this Document

- 1.2.1 American College of Radiology-National Electrical Manufacturers Association (ACR-NEMA) Digital Imaging and Communications v2.0, 1988.
- 1.2.2 ACR-NEMA Digital Imaging and Communications in Medicine (DICOM) v3.0, Final Draft, Aug. 1993.

1.3 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this document.

- **ACR** American College of Radiology
- **ANSI** American National Standards Institute
- **DICOM** Digital Imaging and Communications in Medicine
- **DIMSE** DICOM Message Service Element
- **DIMSE-C** DICOM Message Service Element-Composite
- **DIMSE-N** DICOM Message Service Element-Normalized
- **NEMA** National 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
- **UID** Unique Identifier

1.4 Connectivity Advisory

The use of this Conformance Statement by itself does not guarantee successful inter-operability of ULTRA Acquisition products with equipment from other vendors. The user or integrator should keep the following issues in mind:

- 1.4.1 Successful inter-operability of ULTRA Acquisition products with other devices may require functions that are not specified within the scope of DICOM.
- 1.4.2 ULTRA offers products and services to analyze and validate DICOM connections, including connectivity and data accuracy.

2.0 IMPLEMENTATION MODEL

ULTRA is a PC based product designed to acquire images using a CR reader or DR Flat Panel Detector. ULTRA supports the compression of images and routing to remote devices connected via LAN or WAN.

ULTRA uses DICOM services to:

- Transmit images
- Provide remote access to the content of the server
- Request demographic information to avoid unnecessary typing by technologists

2.1 Application Data Flow Diagram

ULTRA behaves as a single Application Entity according to DICOM. ULTRA initiates associations to send images. ULTRA allows queries based on several standard query models and retrieves requested images. ULTRA initiates associations with a Worklist SCP for the purpose of retrieving demographic information. The application data flow diagram is shown in Figure 1.

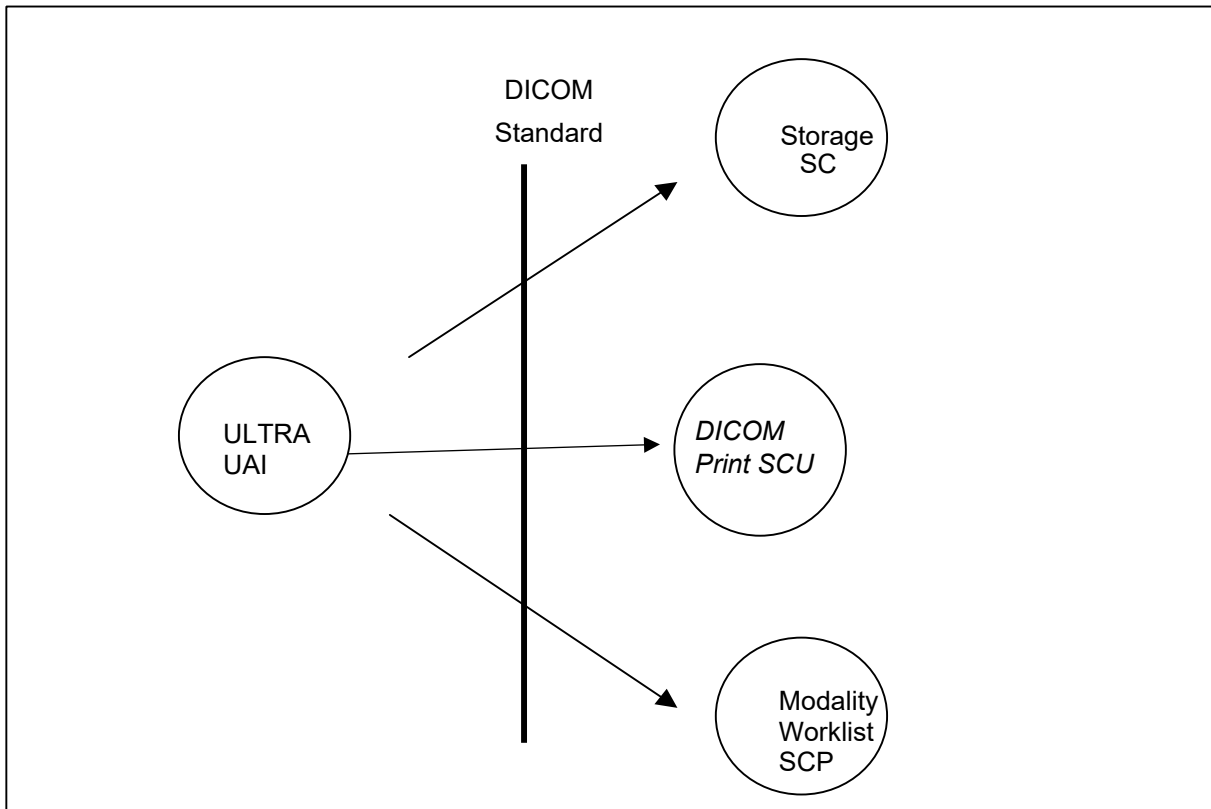


Figure 1: ULTRA Application Data Flow Diagram

2.2 Functional Definitions of Application Entities

ULTRA acts as a Service Class Provider for the purpose of query. ULTRA supports the Query/Retrieve Service Class to allow remote devices query and retrieve access to the local storage.

ULTRA acts as a Service Class User for the purpose of transmitting images. ULTRA utilizes the C-Store service class to transmit images to remote devices. The DICOM CFIND modality service class is used to retrieve demographic information.

- Storage SCP
- Query/Retrieve
- DICOM Print SCU: Initiates association with DICOM compliant print devices. If association is accepted, Ultra UAI sends a DICOM Print request and specified data to the print device
- Modality Worklist SC
- Generator

2.3 Sequencing of Real-World Activities

Not applicable.

3.0 APPLICATION ENTITY SPECIFICATIONS

ULTRA provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU.

Table 1: Supported SCU SOP classes

SOP Class	SOP Class UID
Modality Worklist Info Model – FIND	1.2.840.10008.5.1.4.31
Basic Grayscale Print Management	1.2.840.10008.5.1.1.9
Digital X-Ray Image Storage for Presentation	1.2.840.10008.5.1.4.1.1.1.1
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67
Verification	1.2.840.10008.1.1

ULTRA supports the following Transfer Syntaxes.

Table 2: SOP Output Compression type

SOP Class	SOP Class UID
Implicit VR Little Endian	1.2.840.10008.1.2
JPEG Lossless	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless	1.2.840.10008.1.2.4.90
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG 2000 Lossy	1.2.840.10008.1.2.4.91
Explicit VR Little Endian	1.2.840.10008.1.2.1

3.1 Association Establishment Policies

3.1.1 General

ULTRA 's maximum PDU size is 16352 bytes.

3.1.2 Number of Associations

ULTRA can initiate multiple associations concurrently. A configuration parameter is provided to limit the number of associations that can be originated.

3.1.3 Asynchronous Nature

ULTRA allows a single outstanding operation on any association. Therefore, ULTRA does not support asynchronous operations window negotiation, other than the default as specified by the DICOM specification.

3.1.4 Implementation Identifying Information

ULTRA will respond with the following implementation identifying parameters:

- Implementation Class UID: 1.2.40.1.6.8.168
- Implementation Version Name: uaidicom20140919

3.1.5 Called/Calling Titles

The called/calling title that ULTRA will use is configurable.

3.2 Association Initiation by Real World Activity

ULTRA will issue a new association with a remote device when images are to be transmitted.

3.2.1 Real World Activity - Storage

3.2.1.1 Associated Real World Activity - Storage

ULTRA will issue a Storage request when a user of ULTRA wishes to send a study of images to a remote DICOM SCP.

3.2.1.2 Final Dataset – Storage

Images requested for storage by ULTRA will contain the following Attributes:

Table 3: Final Dataset

Attribute Name	Tag	VR	Value
File Meta Information Version	0002 0001	UI	new byte [] {0,1}
Media Storage SOP Class UID	0002 0002	UI	
Media Storage SOP Instance UID	0002 0003	UI	
Transfer Syntax UID	0002 0010	UI	
Implementation Class UID	0002 0012	UI	
Implementation Version Name	0002 0013	SH	
Image Type	0008 0008	CS	For Value 1, "ORIGINAL" for original image and "DERIVED" for all images derived from original. For Value 2, "PRIMARY".
Instance Creator UID	0008 0014	UI	If the study is created by Ultra, the value will be 1.2.766.40011.33.62.1.414

Attribute Name	Tag	VR	Value
SOP Class UID	0008 0016	UI	When sending DICOM data to PACS with modality DX, the value 1.2.840.10008.5.1.4.1.1.1.1 is used. When sending DICOM data to PACS with the modality CR, the value 1.2.840.10008.5.1.4.1.1.1 is used. When sending DICOM data to IWS, the value 1.2.840.10008.5.1.4.1.1.12.2 is used.
SOP Instance UID	0008 0018	UI	
Study Date	0008 0020	DA	
Series Date	0008 0021	DA	
Acquisition Date	0008 0022	DA	
Content Date	0008 0023	DA	
Study Time	0008 0030	TM	
Series Time	0008 0031	TM	
Acquisition Time	0008 0032	TM	
Content Time	0008 0033	TM	
Modality	0008 0060	CS	CR, DX, or RF. Sending DICOM data with the modality RF is reserved for IWS.
Presentation Intent Type	0008 0068	CS	"FOR PRESENTATION". If being sent to IWS, the value "FOR PROCESSING" will be used.
Manufacturer	0008 0070	LO	KONICA MINOLTA
Institution Name	0008 0080	LO	
Study Description	0008 1030	LO	
Series Description	0008 103E	LO	Will be set to the view name of the image.
Operator Name	0008 1070	PN	
Manufacturer Model Name	0008 1090	LO	Ultra
Derived Image	0008 2111	ST	Refer to Table 5
Anatomic Region Seq	0008 2218	SQ	
Patient Age	0010 1010	AS	
Body Part Examined	0018 0015	CS	

Attribute Name	Tag	VR	Value
KVP	0018 0060	DS	Refer to Table 4
Plate ID	0018 1004	LO	Only for CR reader
Software Version	0018 1020	LO	
Frame Time	0018 1063	DS	1.0/ fps * 1000.0
Exposure Time	0018 1150	IS	Refer to Table 4
X-Ray Tube Current	0018 1151	IS	Refer to Table 4
Exposure (mAs)	0018 1152	IS	Refer to Table 4
Exposure (μ As)	0018 1153	IS	Refer to Table 4
Image Area Dose Product	0018 115E	CS	Refer to Table 4
Filter Type	0018 1160	SH	
Imager Pixel Spacing	0018 1164	DS	
Relative X-Ray Exposure	0018 1405	IS	
Exposure Index	0018 1411	DS	
Target Exposure Index	0018 1412	DS	
Deviation Index	0018 1413	DS	
Detector Type	0018 7004	CS	"SCINTILLATOR"
Detector Configuration	0018 7005	CS	"AREA" OR "SLOT"
Detector Description	0018 7006	LT	
Detector ID	0018 700A	SH	Serial number of the FPD
FOV Rotation	0018 7032	DS	Only populated in DICOM data being sent to IWS. Will contain the value 0, 90, 180, or 270, with respect to the clockwise rotation (in degrees) of the image.
FOV H-Flip	0018 7032	CS	Only populated in DICOM data being sent to IWS. Will contain value of YES or NO with respect to whether the image has been horizontally flipped.
Filter Material	0018 7050	CS	
Filter Thickness Minimum	0018 7052	DS	
Filter Thickness Maximum	0018 7054	DS	
Exposure Control Mode	0018 7060	CS	

Attribute Name	Tag	VR	Value
Exposure Time in μ S Attribute	0018 8150	DS	Store the exposure in microseconds
Series Instance UID	0020 000E	UI	
Study ID	0020 0010	SH	
Series Number	0020 0011	IS	
Instance Number	0020 0013	IS	
Patient Orientation	0020 0020	CS	
Image Laterality	0020 0062	CS	"U"
Samples Per Pixel	0028 0002	US	1
Photometric Interpretation	0028 0004	CS	"MONOCHROME2" or "MONOCHROME1"
Number of Frames	0028 0008	IS	Number of active frames (EndFrame – StartFrame+1)
Frame Increment Pointer	0028 0009	AT	"0018,1063" (0018 1063) FrameTime
Rows	0028 0010	US	
Columns	0028 0011	US	
Pixel Spacing	0028 0030	DS	
Bits Allocated	0028 0100	US	16
Bits Stored	0028 0101	US	Sending DICOM data to PACS will use the value 12 . Sending DICOM data to IWS will use the value 16 .
High Bit	0028 0102	US	Sending DICOM data to PACS will use the value 11 . Sending DICOM data to IWS will use the value 15 .
Pixel Representation	0028 0103	US	0
Burned in Annotation	0028 0301	CS	"NO"
Pixel Intensity Relationship	0028 1040	CS	"LIN"
Pixel Intensity Relationship Sign	0028 1041	SS	1
Window Center	0028 1050	DS	
Window Width	0028 1051	DS	
Rescale Intercept	0028 1052	DS	0
Rescale Slope	0028 1053	DS	1

Attribute Name	Tag	VR	Value
Rescale Type	0028 1054	LO	"US"
Window Center Width Explanation	0028 1055	LO	"ORIGINAL"
Lossy Image Compression	0028 2110	CS	"00"
LUT Descriptor	0028 3002	US	
LUT Explanation	0028 3003	LO	"PRESENTATION"
LUT Data	0028 3006	US	
VOI LUT Seq	0028 3010	SQ	
Representative Frame Number	0028 6010	US	Frame number for "hero" image.
Acquisition Context Seq	0040 0555	SQ	
Presentation LUT Shape	2050 0020	CS	"IDENTITY" OR "INVERSE"
Pixel Data	7FE0 0010	OW	Width*Height*NumberOfFrames*2 total bytes

NOTE: ULTRA Dose reporting information

Table 4: Dose reporting information

	Static	Dynamic	Dynamic Single frame
Original image (even if cropped)	Original total dose	Original total dose (full exam)	NA
Original Moved (from study to other study)	Original total dose	Original total dose (full exam)	NA
Recovered Original (even in different study)	Original total dose	Original total dose (full exam)	NA
Undeleted Other (even in different study)	Original total dose	Original total dose (full exam)	Dose of single frame
Duplicate image (No link to original)	Original total dose	NA	NA
Sub sequence (link to original)	NA	Original total dose (full exam)	Dose of single frame
Merged (stitching, link to originals)	No dose reported	NA	NA

Table 5: Derived Image information

Type of Image	DICOM TAG information (ST)
Undeleted Other (even in different study)	DERIVED image due to copy of original
Duplicate image (No link to original)	DERIVED image due to copy of original
Sub sequence (link to original)	DERIVED image due to copy and clipping of original
Merged (stitching, link to originals)	DERIVED image due to merging of multiple images

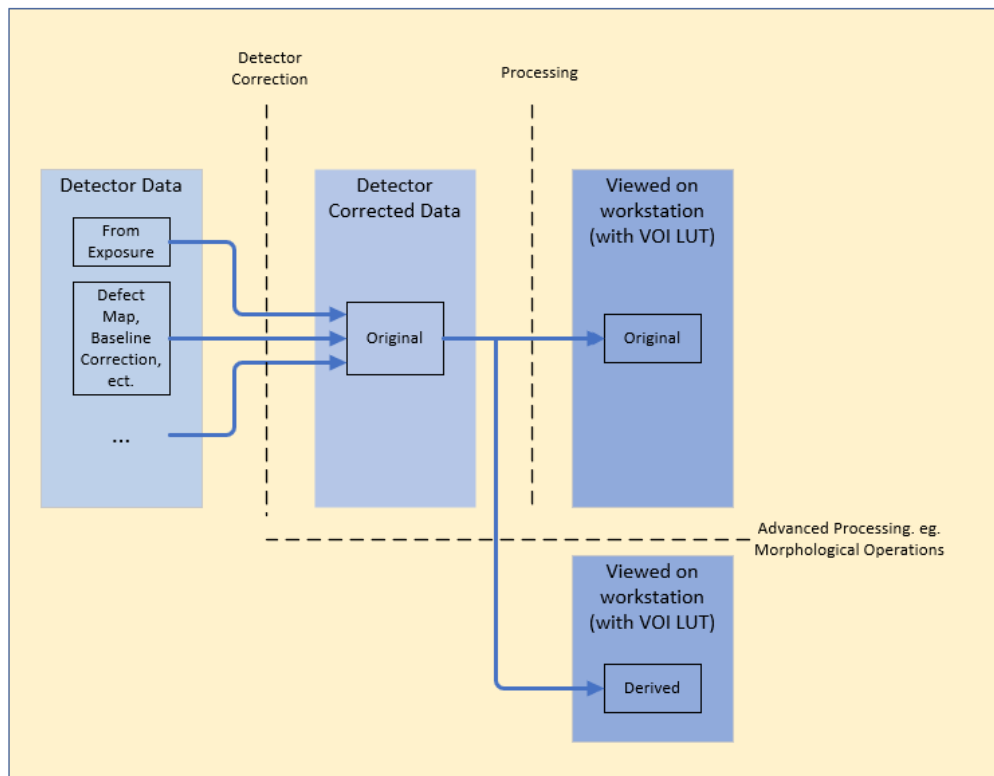


Figure 2: Explanation of Original and Derived Image

Table 6: Dataset Sending Procedure

Attribute Name	Tag	VR	Value
Study Instance UID	0020 000D	UI	This value is generated by combining the following values into one UID: Implementation Class UID IPv4 Address without periods Current Date/Time in the format "yyMMddHHmmssffffff"
Series Instance UID	0020 000E	UI	
Series Number	0020 0011	IS	

Attribute Name	Tag	VR	Value
Instance Number	0020 0013	IS	
Study Date	0008 0020	DA	
Study Time	0008 0030	TM	

3.2.1.3 Compression Types - Storage

ULTRA supports the following SOP class compression types as output

Table 7: SOP Output Compression type

SOP Class	SOP Class UID
Implicit VR Little Endian	1.2.840.10008.1.2
JPEG Lossless	1.2.840.10008.1.2.4.70
JPEG 2000 Lossless	1.2.840.10008.1.2.4.90
JPEG Extended	1.2.840.10008.1.2.4.51
JPEG 2000 Lossy	1.2.840.10008.1.2.4.91
Explicit VR Little Endian	1.2.840.10008.1.2.1
Digital X-Ray Image Storage for Presentation	1.2.840.10008.5.1.4.1.1.1.1

3.2.1.4 Real World Activity – Store Commit

The following Attributes will be used by the Store Commit to send images:

Table 8: Store Commit Attributes

Attribute Name	Tag	VR	Value
Ref SOP Class UID	0008 1150	UI	
Ref SOP Instance UID	0008 1155	UI	
Transaction UID	0008 1195	UI	

3.2.2 Real World Activity - Modality Worklist Management

3.2.2.1 Associated Real World Activity - Modality Worklist Management

ULTRA users can specify different queries for the worklist. ULTRA will then request DIMSE-C FINDs.

3.2.2.2 Presentation Context Table - Modality Worklist Management

ULTRA will present the presentation contexts listed in Table 9.

Table 9: Modality Worklist Presentation Contexts

Abstract Syntax		Transfer Syntax	Role	Extended Negotiation
SOP Class	SOP Class UID			
Modality Worklist Info Model - FIND	1.2.840.10008.5.1.4.31	All from Table 2	SCU	None

3.2.2.3 SOP Specific Conformance - Modality Worklist Management

ULTRA provides standard conformance to the DICOM Basic Worklist Management Service Class. ULTRA supports all required matching key types:

- SV single valued match
- WC wild card match
- SQ sequence match
- DR date range match

ULTRA uses the following elements for this SOP class

Table 10: Modality Worklist Information Model Attributes

Module	Attribute Name	Tag	Match	Return
SOP Common	Specific Character Set	0008 0005		1C
Scheduled Procedure Step	Scheduled Procedure Step Sequence	0040 0100	SQ	1
	>Scheduled Station AE Title	0040 0001	SV	1
	>Scheduled Procedure Step Start Date	0040 0002	DR	1
	>Scheduled Procedure Step Start Time	0040 0003	DR	1
	>Modality	0008 0060	SV	1
Requested Procedure	Referenced Study Sequence	0008 1110		2
	>Referenced SOP Class UID	0008 1150		1C
	>Referenced SOP Instance UID	0008 1155		1C
	Study Instance UID	0020 000D	SV	1
	Requested Procedure Description	0032 1060		1C
	Requested Procedure ID	0040 1001		1
Imaging Service Request	Accession Number	0008 0050	SV	2
	Referring Physician's Name	0008 0090		2
Patient Identification	Patient Name	0010 0010	WC	1
	Patient ID	0010 0020	SV	1

Module	Attribute Name	Tag	Match	Return
Patient Demographic	Patient Birth Date	0010 0030		2
	Patient Sex	0010 0040		2

3.2.3 Real World Activity – DICOM Print

3.2.3.1 SOP Print Negotiator Request Classes

ULTRA uses the following SOP classes in the construction of Negotiator Context Requests:

Table 11: SOP Print Negotiator Request Classes

Print Class		Role	Extended Negotiation
SOP Class	SOP Class UID		
Basic Grayscale Print Management	1.2.840.10008.5.1.1.9	SCU	None
Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.3.2 SOP Print Request Construction Classes – DICOM Print

ULTRA uses the following SOP classes in the construction of Print requests:

Table 12: SOP Print Request Construction Classes – DICOM Print

Print Class		Role	Extended Negotiation
SOP Class	SOP Class UID		
Basic Film Session	1.2.840.10008.5.1.1.1	SCU	None
Basic Film Box SOP	1.2.840.10008.5.1.1.2	SCU	None

3.2.3.3 DICOM Print Attribute Tags

3.2.3.3.1 Creating a Film Session

Table 13: Film Session Creation

Attribute Name	Tag	VR	Value
Number of Copies	2000 0010	IS	
Print Priority	2000 0020	CS	
Medium Type	2000 0030	CS	
Film Destination	2000 0040	CS	
Memory Allocation	2000 0060	IS	

3.2.3.3.2 Creating a Film Box

Table 14: Film Box Creation

Attribute Name	Tag	VR	Value
Image Display Format	2010 0010	SQ	
Film Orientation	2010 0040	CS	
Film Size ID	2010 0050	CS	
Magnification Type	2010 0060	CS	
Border Density	2010 0100	CS	
Empty Image Density	2010 0110	CS	
Trim	2010 0140	CS	

3.2.3.3.3 Setting an Image Box

Table 15: Setting an Image Box

Attribute Name	Tag	VR	Value
Image Position on Film	2020 0010	US	
Requested Image Size	2020 0030	DS	
Basic Grayscale Image Seq	2020 0110	SQ	

3.2.3.3.4 Adding an Image

Table 16: Generate Final Printer Dataset

Attribute Name	Tag	VR	Value
Samples Per Pixel	0028 0002	US	1
Photometric Interpretation	0028 0004	CS	"MONOCHROME2" or "MONOCHROME1"
Rows	0028 0010	US	
Columns	0028 0011	US	
Pixel Spacing	0028 0030	DS	
Pixel Aspect Ratio	0028 0034	IS	new int [2] {1,1}
Bits Allocated	0028 0100	US	8
Bits Stored	0028 0101	US	8
High Bit	0028 0102	US	7
Pixel Representation	0028 0103	US	0

Attribute Name	Tag	VR	Value
Window Center	0028 1050	DS	128
Window Width	0028 1051	DS	256
Pixel Data	7FE0 0010	OB	

4.0 COMMUNICATIONS PROFILES

ULTRA provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.1 TCP/IP Stack

ULTRA inherits its TCP/IP stack from the computer system upon which it executes.

4.1.1 Physical Media Support

ULTRA is indifferent to the physical medium over which TCP/IP executes; it inherits the medium from the computer system upon which it executes.

5.0 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

ULTRA SCU/SCP may implement specialized image decompression for support of certain Teleradiology applications. See section 3.2.2.3.3 for details.

6.0 CONFIGURATION

ULTRA obtains configuration information from the following sources:

- Mapping from Application Entity Title to Presentation Address is provided by the database.
- Configuration table stores Application Entity Title, default PDU size, and preferred byte orders for the SOP classes that ULTRA supports.

7.0 SUPPORT FOR EXTENDED CHARACTER SETS

ULTRA supports the following character sets:

- ISO-IR 6 (default) Basic G0 Set
- ISO-IR 100 Latin Alphabet No. 1

7.1 Ultra MWL Supported Specific Character Set Defined Terms

Table 17: Supported Character Set Defined Terms

Character Set Description	DICOM attribute: Specific Character Set (0008,0005)	Encoding
Latin alphabet No. 1	ISO_IR 100	ISO-8859-1
Latin alphabet No. 2	ISO_IR 101	ISO-8859-2
Default Repertoire	ISO 2022 IR 6	US-ASCII (7-Bit)