CT SCANNER PERFORMANCE EVALUATION

GREEN LIGHT IMAGING, LLC
Medical Mobile Diagnostics
8348 Rosemead Blvd
Pico Rivera, CA 90660

(562)222-1321

CT Trailer #4
GE Optima CT520
Gantry S/N: 377671HM3

Survey Date: July 8, 2021

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CT SCANNER PERFORMANCE EVALUATION SUMMARY

Site:	**GREEN LIGHT IMAGING, LLC**	**Report Date:**	July 10, 2021
	8348 Rosemead Blvd	**Survey Date:**	July 8, 2021
	Pico Rivera, CA 90660		
X-Ray Unit Manufacturer:	General Electric Medical Systems	**Model:**	Optima CT520
Date Manufactured:	July 1, 2014	**Room ID:**	CT Trailer #4
Medical Physicist:	Khachig A. Jerjian, Ph.D.	**Signature:**	K. Jerjian, Ph.D. Digitally signed by K. Jerjian, Ph.D. DN: cn=K. Jerjian, Ph.D., o=ABMP, inc, email=kjmedicalphysics@gmail.com, c=US Date: 2021.07.14 13:01:17 -06'00'

		PASS/FAIL/NA
1.	Review of Clinical CT Protocols	PASS
2.	Scout Prescription Accuracy Evaluation	PASS
3.	Laser Light Alignment Accuracy Evaluation	PASS
4.	Table Travel Accuracy Evaluation	PASS
5.	Radiation Beam Width Accuracy Evaluation	PASS
6.	Slice Thickness Accuracy Evaluation	PASS
7.	High Contrast Spatial Resolution Evaluation	PASS
8.	Low Contrast Performance Evaluation	PASS
9.	CT Number Accuracy Evaluation	
	a. CT Number Accuracy and Linearity Evaluation	PASS
	b. CT Number Contrast Scale Evaluation	PASS
	c. CT Number Dependence on Slice Thickness Evaluation	PASS
	d. CT Number Dependence on kVp Evaluation	PASS
	e. CT Number and Image Uniformity Evaluation	PASS
10.	Artifact Evaluation	PASS
11.	Dosimetry Evaluation	PASS
12.	Acquisition Display Device Evaluation	PASS
13.	Radiation Protection Evaluation	
	a. Visual Inspection	PASS
	b. Audible/Visual Warning Signs	PASS
	c. Posting Requirements	PASS
14.	Technologist Quality Control Program Evaluation	PASS

MEDICAL PHYSICS RECOMMENDATIONS & COMMENTS

1. CT scanner performance evaluation was found to be adequate. Performance evaluation test results were within ACR recommended action limits. Deviations in the indicated and measured $CTDI_{vol}$ dose values were within an acceptable range of ± 20%.

2. Select clinical protocols for adult and pediatric patients were reviewed. Protocols were found to be adequate with typical doses within ACR recommended Reference Dose Levels for both head and body protocols.

3. Brain Perfusion CT protocols were not reviewed. Brain CT Perfusions are not performed on this scanner.

4. CT number calibration dependence on kVp and Slice Thickness was found to be adequate for all kVp stations. CT Number linearity and contrast scale were also found to be adequate.

5. Technologist QC program is well established. Daily QC procedures are properly performed and periodically documented. Recommend properly documenting the monthly visual checklist and display monitor QC tests also.

6. Detailed accounts of this performance evaluation may be obtained by contacting us directly at (949)683-5215 or by e-mail at kjmedicalphysics@gmail.com.

Khachig A. Jerjian, Ph.D., DABR
Medical Physicist

Date: July 10, 2021

1. REVIEW OF ROUTINE CLINICAL CT PROTOCOLS

This CT scanner performance evaluation was performed using the ACR CT Accreditation Program Phantom and routine clinical head and abdomen protocols used at this facility. Test procedures were consistent with ACR CT Accreditation Program guidelines.

Table 1. Routine Protocols

For this section, techniques used on an average patient or average technique calculated from several patient images is recorded.	**Adult Head**	**Adult Abdomen**	**Pediatric Head (1 Year Old)**	**Pediatric Abdomen (5 Year Old)**
kVp	120	120	100	100
mA	150	275	190	200
Time per Rotation (sec)	2.0	1.0	0.8	0.8
System Calculated mAs	300	275	152	160
Effective mAs (or mAs per slice) as displayed	300	200	152	116
Scan FOV (cm)	Head(25 cm)	Large(50 cm)	Ped(25 cm)	Small(25 cm)
Display FOV (cm)	25 cm	36 cm	25 cm	25 cm
Reconstruction Algorithm	Stnd	Stnd Plus	Standard	Std Plus
Axial (A) or Helical (H) Scan	A	H	A	H
Acquisition Slice Thickness Z-Axis Collimation (T in mm)	1.25	1.25	1.25	1.25
Number of Slices per Tube Rotation - # of Data Channels Used (N)	16	16	16	16
Table Increment (mm) (axial scans) or Table Speed (mm/rot)(helical scans) (I)	20.0	27.5	20.0	27.5
IEC definition of Pitch for this protocol (Pitch = I / N * T) (calculated by the System)	1.0	1.375	1.0	1.375
Reconstructed Scan Width (mm)	5.0	2.5	5.0	2.5
Reconstructed Scan Interval (mm)	5.0	2.5	5.0	2.5
Dose Reduction Technique(s) used in routine patient scanning for these protocols (*Note: The ACR and CTDI phantoms are NOT scanned with dose reduction options.*)		Auto mA 75-350 mA Noise Index 15.86	Auto mA 50-190 mA Noise Index 1.41	Auto mA 50-200 mA Noise Index 12.69
Indicated CTDIvol (mGy)	51.29 mGy	17.26 mGy	17.24 mGy	13.33 mGy
Reference Dose Phantom Size	Head 16	Body 32	Head 16	Head 16

The facility clinical protocol acquisition and reconstruction parameters were reviewed for specific requirements of the diagnostic imaging task, adequate image quality and dose. The above listed protocols were found to be adequate. The High Resolution Chest protocol was also found to be adequate. Brain Perfusion protocols were not reviewed. Brain Perfusions are not performed on this scanner.

2. SCOUT PRESCRIPTION ACCURACY EVALUATION

Phantom: ACR CT Accreditation Phantom

Technique: 120 kVp, 200 mA, 0.8 sec Rotation Speed, 160 mAs, Axial Mode, 2x0.625 mm Detector Configuration, 1.25 mm Slice Thickness, Bone Reconstruction Algorithm, Large SFOV, 21 cm DFOV, 512x512 Image Matrix.

Following proper position and leveling of the phantom on the scan table at the center of the gantry and acquisition of scout images, 1.25 mm thick axial images were prescribed at the center of modules 1 and 4 of the ACR CT Accreditation phantom at table landmark position of +0 mm and at table location 120 mm superior to the landmark position. Slice localization from scout prescription accuracy was evaluated using images of embedded 1 mm diameter BBs at the surface of modules 1 and 4 of the ACR phantom.

Detector Configuration	Nominal Position	Actual Location	Deviation (mm)
1i 2x0.625 mm	Landmark Location	0.0 mm	0.0 mm
	Superior +120 mm	+120.0 mm	0.0 mm

Conclusion: Slice localization from scanned projection radiographs/scout was found to be adequate, accurate to within ± 1 mm.

3. LASER LIGHT ALIGNMENT ACCURACY EVALUATION

Detector Configuration	Nominal Position	Actual Location	Deviation (mm)
1i 2x0.625 mm	Landmark Location	0.0 mm	0.0 mm
	Azimuth 0° Laser	Left/Right	0.0 mm
	Azimuth 90° & 270°	Vertical	0.0 mm

- Maximum discrepancy between the internal and external axial laser lights and the plane of radiation field was determined to be less than ± 1 mm. The sagittal and coronal laser light alignment accuracy was also found to be adequate, within ± 2 mm limits.

Conclusion: Bed positioning accuracy and congruence of the laser light beam localizer with the imaging plane was found to be adequate.

4. TABLE TRAVEL ACCURACY EVALUATION

Detector Configuration	Nominal Position	Actual Location	Deviation (mm)
1i 2x0.625 mm	Landmark Location	0.0 mm	0.0 mm
	Superior +120 mm	+120.0 mm	0.0 mm

- Maximum discrepancy in bed repositioning was determined to be less than ± 1 mm.

Conclusion: CT scanner table motion was accurate, reproducible and consistent with digital system indicators. Bed travel and indexing/incrementation accuracy was found to be adequate and reproducible to within ±1 mm.

5. BEAM WIDTH ACCURACY EVALUATION

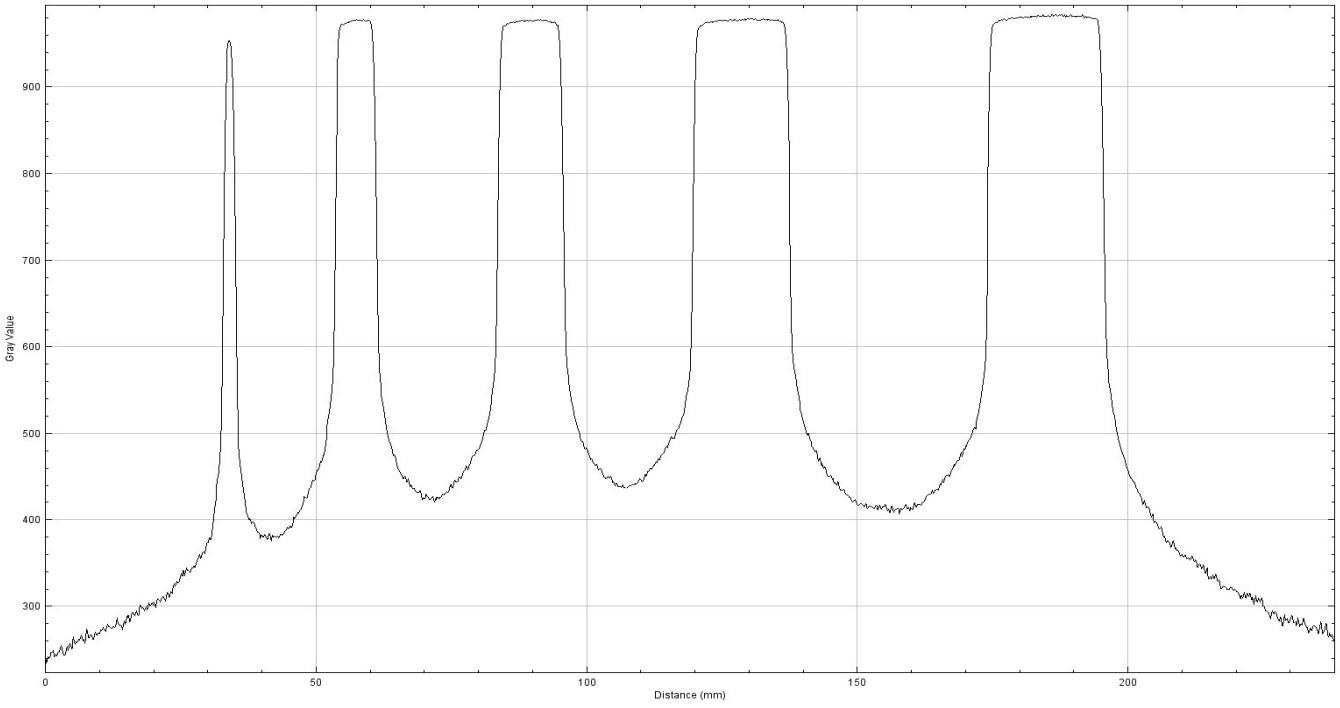
Phantom: CR Plate

Technique: 80 kVp, 10 mA, 0.8 sec Rotation Speed, 8 mAs, Axial Mode, Detector Configuration and Slice Thicknesses as indicated, Standard Reconstruction Algorithm, Large SFOV, 40 cm DFOV, 512x512 Image Matrix.

A CR plate was positioned at the iso-center and axial images were acquired at selected location. Beam widths were measured at the FWHM of the slice profiles.

Detector Configuration (Prescribed Width NxT)	Prescribed Beam Width	Measured Beam Width	Difference	Status (Pass/Fail Criteria)
2i 2x0.625 mm	1.25 mm	2.3 mm	1.1 mm	PASS (≤ 3.0 mm)
4i 4x1.25 mm	5.0 mm	7.7 mm	2.7 mm	PASS (≤ 3.0 mm)
16i 16x0.625 mm	10 mm	12.2 mm	2.2 mm	PASS (≤ 3.0 mm)
4i 4x3.75 mm	15 mm	17.9 mm	2.9 mm	PASS (≤ 4.5 mm)
16i 16x1.25 mm	20 mm	21.5 mm	1.5 mm	PASS (≤ 6.0 mm)

Conclusion: Measured beam widths were found to be in good agreement with indicated beam widths. Measured beam widths have to be within the larger of ± 3 mm or 30% of prescribed total nominal collimated beam width.



6. SLICE THICKNESS ACCURACY EVALUATION

Phantom: ACR CT Accreditation Phantom Module 1

Technique: 120 kVp, 275 mA, 1.0 sec Rotation Speed, 275 mAs, Axial Mode, Detector Configuration and Slice Thicknesses as indicated, Standard Reconstruction Algorithm, Large SFOV, 21 cm DFOV, 512x512 Image Matrix.

Axial images were acquired at the center of Module 1 of the ACR CT Accreditation phantom. Slice widths were assessed by counting the visible wires on the two ramps containing wires arranged in 0.5 mm z-axis increments.

Detector Configuration (Prescribed Beam Width NxT)	Prescribed Slice Width	Measured Slice Width	Difference
16i 16x0.625 mm	0.625 mm	1.0 mm	< 0.5 mm
16i 16x1.25 mm	1.25 mm	1.5 mm	< 0.5 mm
8i 8x2.5 mm	2.50 mm	2.5 mm	0.0 mm
4i 4x3.75 mm	3.75 mm	4.0 mm	< 0.5 mm
4i 16x1.25 mm	5.0 mm	5.0 mm	0.0 mm
2i 4x3.75 mm	7.5 mm	7.5 mm	0.0 mm

Conclusion: Observed slice widths were found to be in good agreement with the nominal slice widths. Slice widths must be within ± 1.5 mm of the prescribed slice thickness.

7. HIGH CONTRAST SPATIAL RESOLUTION EVALUATION

Phantom: ACR CT Accreditation Phantom

Technique: Routine Adult Head, Adult Abdomen and HR Chest Protocols

The high contrast resolution insert, Module 4 of the ACR Phantom, contains eight bar patterns representing spatial frequencies corresponding to 4, 5, 6, 7, 8, 9, 10 and 12 lp/cm, respectively.

Protocol	High Contrast Spatial Resolution
Routine Adult Brain Protocol	7 lp/cm
Routine Adult Abdomen protocol	7 lp/cm
HR Chest Protocol	10 lp/cm

Conclusion: The limiting high contrast spatial resolution is adequate. The ACR Pass/Fail criteria are 6 lp/cm for standard resolution head and body protocols and 8 lp/cm for the high resolution chest protocol.

8 (a). CONTRAST TO NOISE EVALUATION

Phantom: ACR CT Accreditation Phantom Module 2
Technique: Routine Head and Abdomen Protocols

The low contrast resolution insert, Module 2 of the ACR phantom, contains five different size rod sets with diameters equal to 6 mm, 5 mm, 4 mm, 3 mm, and 2 mm, respectively. The rod sets are considered to be resolved if all four rods of the same size can be clearly visualized .

Contrast to Noise (CNR) Evaluation:

The low contrast resolution insert, Module 2 of the ACR Phantom, was evaluated using a ROI of about 100 mm^2. Image noise was represented by the ROI standard deviation of the background area.

Protocol	Rod Insert ROI (H.U.)	Background ROI (H.U.)	Background ROI (Std. Dev.)	CNR
Adult Brain Axial 5.0 mm	92.2	86.0	4.3	1.4
Adult Abdomen 2.5 mm	90.7	84.7	5.9	1.0
Pediatric Brain	82.3	76.7	8.0	0.7
Pediatric Abd	80.4	75.3	11.0	0.5

Conclusion: Routine Brain and Body protocol contrast to noise ratios were found to be adequate. The CNR must be greater than 1.0 for the adult Brain and adult Abdomen protocols. CNR must be greater than 0.7 for Pediatric Brain and greater than 0.4 for Pediatric Abdomen protocol.

8 (b). LOW CONTRAST RESOLUTION EVALUATION

Phantom: ACR CT Accreditation Phantom Module 2
Technique: Routine Adult Head and Adult Abdomen Protocols

The low contrast resolution insert, Module 2 of the ACR phantom, contains five different size rod sets with diameters equal to 6 mm, 5 mm, 4 mm, 3 mm, and 2 mm, respectively. The rod sets are considered to be resolved if all four rods of the same size can be clearly visualized .

Protocol	Contrast Level	$CTDI_{vol}$ (mGy)	Low Contrast Resolution
Adult Brain	0.6%	51.29 mGy	4 mm
Adult Abdomen	0.6%	17.26 mGy	5 mm
Pediatric Brain (1 Year old)	0.6%	17.24 mGy	5 mm
Pediatric Abdomen (5 Year old)	0.5%	13.33 mGy	6 mm

Conclusion: The ACR Pass/Fail criteria indicate a resolution of 6 mm diameter rods with both adult abdomen and adult brain protocols. The scanner Low Contrast Resolution is estimated to better than 4.0 mm @ 0.6 % contrast at a dose of 51 mGy $CTDI_{vol}$.

9 (a). CT NUMBER ACCURACY AND LINEARITY EVALUATION

Phantom: ACR CT Accreditation Phantom Module 1
Technique: Routine Brain and Abdomen Protocols

Module 1 of the ACR phantom is used to assess CT number accuracy and linearity. There are five cylinders of different materials including a bone mimicking material ("Bone"), polyethylene, water equivalent material, acrylic and air. Each cylinder, except the water cylinder, has a diameter of 25 mm and a depth of 4 cm. The water cylinder has a diameter of 50 mm and a depth of 4 cm. ROI measurements were performed in each insert with an ROI area of ~ 200 mm^2.

Technique: Routine Adult Abdomen Protocol

ACR Phantom Insert	Mean CT Number (HU)	Acceptable CT Number Range		
Polyethylene	-94	-107 HU	to	-84 HU
Water Equivalent	-0.2	-7 HU	to	7 HU
Acrylic	117	110 HU	to	135 HU
Bone	898	850 HU	to	970 HU
Air	-973	-1005 HU	to	-970 HU

Technique: Routine Adult Brain and Pediatric Brain and Abdomen Protocols

PROTOCOL	Adult Brain	Pediatric Brain	Pediatric Abdomen
Polyethylene Insert CT Number (HU)	-94	-105	-104
Water Equivalent Insert CT Number (HU)	1.2	1.0	1.2
Acrylic Insert CT Number (HU)	119	111	110
Bone Insert CT Number (HU)	958	**1090**	**1018**
Air CT Number (HU)	-970	-972	-972

Conclusion: CT number calibration accuracy is adequate. Mean CT number of tested inserts are within ACR recommended ranges.

9 (b). CT NUMBER CONTRAST SCALE EVALUATION

Phantom: ACR CT Accreditation Phantom Module 1
Technique: Routine Adult Brain and Adult Abdomen Protocols

CT number contrast scale was evaluated using the Water and Acrylic inserts in Module 1 of the ACR Phantom. Acrylic/Water CT number contrast scale was represented by the difference in Acrylic and Water CT numbers.

PROTOCOL	Acrylic CT Number	Water CT Number	Contrast Scale	
Routine Adult Brain protocol	117.3	-0.2	118	HU
Routine Adult Abdomen protocol	118.7	1.2	118	HU

Conclusion: Contrast scale is adequate. The acrylic and water CT number difference should be within 120 ± 12 HU.

9 (c). CT NUMBER DEPENDENCE ON SLICE THICKNESS EVALUATION

Phantom: ACR CT Accreditation Phantom Module 1

Technique: Adult Abdomen equivalent axial protocol at 120 kVp, 275 mA, 1.0 sec Rotation Time, Small SFOV, 21 cm DFOV, Standard Body Algorithm, slice thicknesses as indicated and ROI areas of ~ 200 mm^2.

Slice Thickness	Mean CT Number (HU)	Acceptable CT Number Range		
0.625 mm	1.3	-7 HU	to	7 HU
1.25 mm	-0.9	-7 HU	to	7 HU
2.5 mm	-0.5	-7 HU	to	7 HU
3.75 mm	-0.6	-7 HU	to	7 HU
5.0 mm	-0.8	-7 HU	to	7 HU
7.5 mm	-0.2	-7 HU	to	7 HU

Conclusion: CT number dependence on slice thickness is adequate. Mean CT numbers should be within the ACR recommended range of ± 7 HU, and preferably within ± 5 HU.

9 (d). CT NUMBER DEPENDENCE ON kVp EVALUATION

Phantom: ACR CT Accreditation Phantom Module 1

Technique: Routine Adult Abdomen equivalent protocol in axial mode 2.5 mm Slice Thickness, 275 mA, 1.0 sec Rotation Time, and kVp values as indicated with ROI areas of ~ 200 mm^2.

kVp	Mean CT Number (HU)	Acceptable CT Number Range		
80	-6.4	-7 HU	to	7 HU
100	-0.8	-7 HU	to	7 HU
120	-0.3	-7 HU	to	7 HU
140	-1.1	-7 HU	to	7 HU

Conclusion: CT number dependence on kVp is adequate at all kVp settings. Mean CT numbers should be within the ACR recommended range of ± 7 HU, and preferably within ± 5 HU.

9 (e). IMAGE UNIFORMITY EVALUATION

Phantom: ACR CT Accreditation Phantom Module 3

Technique: Routine Adult Abdomen Protocol

The uniformity section insert, Module 3 of the ACR phantom, contains Teflon beads embedded in a uniform water equivalent background. ROI measurements were performed at the center and periphery of the phantom. Area of ROI used was ~ 400 mm2. Image spatial uniformity was depicted by the edge-to-center mean CT number differences.

ACR Phantom	Location	Mean ROI CT Number (H.U.)	ROI Standard Deviation (H.U.)	Difference Center to Edge ROI (H.U.)
ROI ~ 400 mm^2	Center	-1.9	7.1	---
	3 O'Clock	-3.2		1.3
	6 O'Clock	-3.1		1.2
	9 O'Clock	-3.0		1.1
	12 O'Clock	-3.0		1.1

Conclusion: Mean CT number and image spatial uniformity is adequate. The measured mean CT numbers should be in the range of 0 ± 7 Hounsfield Units (HU) and preferably within 0 ± 5 HU. Image spatial uniformity, depicted by the edge-to-center mean CT number differences is also within recommended limits. Edge-to-center mean CT number differences must be less than 5 HU for all four edge positions.

10. ARTIFACT EVALUATION

Phantom: ACR CT Accreditation and CTDI Dose Phantoms

Technique: Routine Adult Brain and Adult Abdomen Protocols

With all graphics turned off and with reduced room lighting, images were viewed for artifacts, such as ring or streak artifacts.

Conclusion: No significant ring, streak or other equipment related artifacts were noted.

11. CT DOSIMETRY EVALUATION

A. CT SCANNER INDICATED COMPUTED TOMOGRAPHY DOSE INDEX ($CTDI_{VOL}$) EVALUATION

Phantom:	16 cm CTDI Acrylic Head and 32 cm CTDI Acrylic Body Phantom
Dosimeter Used:	Radcal Accu-Pro Model 9096 S/N 96-0544
Ion Chamber:	Radcal 10X6-3CT Ion Chamber
Technique:	Axial Brain and Abdomen Protocols

Weighted $CTDI_{w,100}$ Dose Measurements using CTDI Dose Phantoms:

Scan Protocols	kVp	mA	Scan Time (sec)	SFOV (cm)	Scan Type	Indicated $CTDI_{vol}$ (mGy)	Measured $CTDI_{w}$ (mGy)	Percent Difference
Adult Brain (16x1.25 mm)	120	150	2.0	Head (25 cm)	Axial	51.29 (Head16)	51.05	0%
Adult Abdomen (16x1.25 mm)	120	275	1.0	Large (50 cm)	Axial	23.74 (Body32)	23.71	0%
Pediatric Brain (16x1.25 mm)	100	190	0.8	Ped Head (25 cm)	Axial	17.24 (Head16)	16.05	-7%
Pediatric Abdomen (16x1.25 mm)	100	200	0.8	Small (25 cm)	Axial	18.33 (Head 16)	17.38	-5%

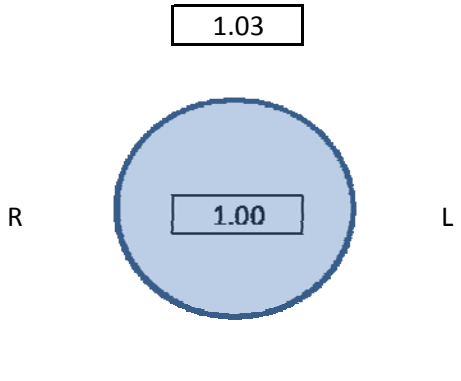
CONCLUSION: Measured $CTDI_{w}$ values were found to be consistent with indicated $CTDI_{vol}$ values. Percent differences were within an acceptable range of ± 20.0%.

RADIATION DOSE UNIFORMITY*

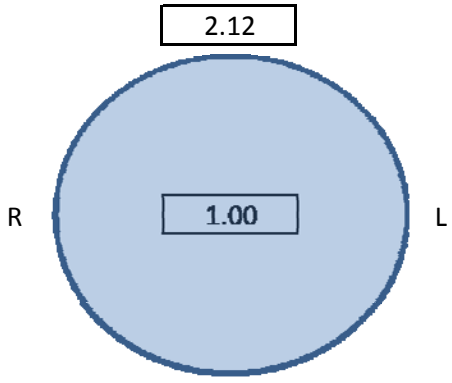
**Note: Phantom surface dose factors normalized relative to the value at the center location*

Technique:	120 kVp Adult Techniques as indicated in table above

16 cm CTDI Head Dose Phantom



32 cm CTDI Body Dose Phantom



11. CT DOSIMETRY EVALUATION (Continued)

B. PATIENT DOSE EVALUATION FOR REPRESENTATIVE CT EXAMINATIONS

Phantom: 16 cm CTDI Acrylic Head and 32 cm CTDI Acrylic Body Phantom
Technique: Routine Brain and Abdomen Protocols

Correspondence of Measured and Indicated $CTDI_{vol}$ Doses for Select Clinical Protocols:

Protocols	Measured $CTDI_{vol}$ (mGy)	Indicated $CTDI_{vol}$ (mGy)	Reference CTDI Dose Phantom	Percent Difference
Adult Brain	51.05 mGy	51.29 mGy	Head 16 cm	0%
Adult Abdomen	17.25 mGy	17.26 mGy	Body 32 cm	0%
Pediatric Brain	16.05 mGy	17.24 mGy	Head 16 cm	-7%
Pediatric Abdomen*	12.64 mGy	13.33 mGy	Head 16 cm	-5%

CONCLUSION: Measured $CTDI_{vol}$ dose values were found to be consistent with indicated $CTDI_{vol}$ values. Percent differences were within an acceptable range of ± 20%.

*Note: Pediatric Abdomen dose measured using the "Small" SFOV and the small (16 cm Diameter) CTDI Phantom.

C. PATIENT DOSE EVALUATION FOR REPRESENTATIVE CT EXAMINATIONS

Effective Dose Estimates for Select Clinical Protocols

Protocols	Measured $CTDI_{vol}$ (mGy)	Scan Length	Dose Length Product DLP (mGy.cm)	Effective Dose (mSv)
Adult Brain	51.05 mGy	17.5 cm	893 mGy.cm	1.9 mSv
Adult Abdomen (SSDE**)	17.67 mGy	25.0 cm	442 mGy.cm	6.6 mSv
Pediatric Brain	16.05 mGy	12.0 cm	193 mGy.cm	1.3 mSv
Ped Abdomen (SSDE**)	11.58 mGy	15.0 cm	174 mGy.cm	3.5 mSv

CONCLUSION: $CTDI_{vol}$ dose values and Effective Dose estimates are well within the ACR recommended limits. Attached, please find dose calculator spreadsheets for further details. Measured $CTDI_{vol}$ values should be less than the ACR Pass/Fail Criteria tabulated below, and preferably less than the ACR Reference Dose Levels.

**SSDE: Size Specific Dose Estimate

ACR $CTDI_{vol}$ Pass/Fail Criteria and CT Dose Reference Levels

CT Examination	ACR Pass/Fail Criteria $CTDI_{vol}$ (mGy)	ACR Reference Levels $CTDI_{vol}$ (mGy)
Adult Head	80 mGy	75 mGy
Adult Abdomen	30 mGy	25 mGy
Pediatric Head (1 year old)	40 mGy	35 mGy
Pediatric Abdomen (40-50 lb) - 16 cm Diameter CTDI Phantom	20 mGy	15 mGy
Pediatric Abdomen (40-50 lb) - 32 cm Diameter CTDI Phantom	10 mGy	7.5 mGy

12 (a). ACQUISITION DISPLAY DEVICE EVALUATION

Luminance Meter Make/Model: Unfors Xi Photometer

Acquisition display devices were evaluated using a standard SMPTE test pattern:

1. The 5% and the 95% square contrast patterns were properly resolved and visualized.
2. Each gray-level step from 0% to 100% was uniform and distinct from the adjacent step.
3. The borders and lines of the SMPTE pattern were straight.
4. No spatial distortions or misalignments were noted in the grids across the screen.
5. Alphanumeric characters looked sharp and focused.
6. The high contrast line-pair resolution patterns in the center and corners of the display area were linear, properly resolved and adequately visualized without any magnification.
7. No streaking was noted in and around the white and black rectangular patterns.

The overall appearance of the SMPTE pattern was found to be adequate.
The soft copy display monitor resolution and spatial accuracy was found to be adequate.
No significant distortions or any kind of non-linearities were noted in any of the target patterns.

Monitor NEC MultiSync LCD 1980SXi	Minimum Luminance (Black Level)	Maximum Luminance (White Level)	% Luminance Non-Uniformity
Acquisition Workstation Display	0.3 cd/m^2	125 cd/m^2	15%

The minimum luminance (Black Level) should be less than 1.2 cd/m^2.
The maximum luminance (White Level) should be greater than or equal 100 cd/m^2 for diagnostic workstations.
The display luminance uniformity is considered adequate if percent luminance non-uniformity is within ± 15%.

CONCLUSION: The display monitor minimum & maximum luminances and uniformity were found to be adequate.

12 (b). SPATIAL DISTORTION EVALUATION

Phantom: ACR CT Accreditation Phantom Module 3
Technique: Routine Adult Abdomen Protocol
Spatial distortion and distance measurement accuracy was evaluated by measuring the known dimensions of the ACR phantom and set distance between the Teflon BB's in Module 3.

A. Distance Gauge Check:

Orientation of BB's	Actual Distance Between BB's	Scanner Measured Distance	Percent Difference
45°	10.0 cm	10.0 cm	0.0%

B. Aspect Ratio of Video Monitor and Imager (if available):

ACR Phantom	Aspect Ratio
Ratio of Horizontal to Vertical Dimensions of Circular Phantom Object	1.00
Ratio of Horizontal to Vertical Dimensions of Object on the Monitor	1.00
Ratio of Horizontal to Vertical Dimensions of Object on Film	N/A

CONCLUSION: The scanner distance measurement accuracy is adequate. There are no significant spatial distortion of the image on the monitors.

13. RADIATION SAFETY EVALUATION

A. Visual Inspection
A visual safety inspection of the CT Trailer and surroundings was conducted. No unsafe conditions were noted.

B. Audible and Visual Warning Signs
System audible and visual warning signs are functional and performing adequately. Dose Notification and Dose Alert features are activated and functioning properly.

C. Posting Requirements
CT scanner room was appropriately posted with a "Caution X-Ray" warning sign.

14. TECHNOLOGIST QUALITY CONTROL PROGRAM

A. Technologist QC program is well established. Daily QC procedures are properly performed and documented on the days the scanner is used. Recommend documenting the visual checklist and display monitor QC tests also on a monthly basis.

Quality Control Procedures	Responsible Individual	Frequency	STATUS
1. Water CT Number Accuracy Eval	CT Technologist	Daily	PASS
2. Image Noise Evaluation	CT Technologist	Daily	PASS
3. Artifact Evaluation	CT Technologist	Daily	PASS
4. Visual Checklist	CT Technologist	Monthly	PASS
5. Dry Laser QC	CT Technologist	N/A	N/A
6. Acquisition Display QC	CT Technologist	Monthly	PASS

B. Preventive maintenance program is well established. Regular PMs are periodically performed and documented by qualified field service engineers.

ACR CT ACCREDITATION DOSE SPREADSHEET

IMPORTANT NOTE: This Excel Workbook contains formulae essential to accurate reporting of dose for ACR CT Accreditation. It is intended to be used with both Windows and Mac operating systems. Please note, ANY alteration of the formulae will very likely result in errors of reported data, and could adversely affect our accreditation results. You must enter accurate data from this workbook into the ACRedit online testing package. Please check the results from this workbook against the results shown in the ACRedit database online testing package before submission.

Dose Calculator Spreadsheet (Exposure)

CTAP ID Number

Radiation Dosimetry (Adult Head)

CTDI Head Phantom (16-cm diameter PMMA Phantom)	Measured	Calculated
kV	120	
mA	150	
Exposure time per rotation (s)	2	
# data channels used (N)[1]	16	
Z-axis collimation (T)[1]	1.25	
Axial (A): Table Increment (mm) = (I)[1] OR Helical (H):Table Speed (mm/rot) = (I)[1]	20	
Active Chamber length (mm)	100	
Chamber correction factor	1	
Center		
Measurement 1 (mR)	1155	
Measurement 2 (mR)	1160	
Measurement 3 (mR)	1146	
Average of above 3 measurements (mR)		1154
Head CTDI at isocenter in phantom (mGy)		50.2
12 o'clock position		
Measurement 1 (mR)	1183	
Measurement 2 (mR)	1181	
Measurement 3 (mR)	1186	
Average of above 3 measurements (mR)		1184
Head CTDI at 12 o'clock position in phantom (mGy)		51.5
CTDIw (mGy)		51.05
Clinical exam dose estimates (using measured CTDIw and site's Adult Head Protocol from Table 1)		
CTDIvol (mGy)	=CTDIw*N*T/I	51.05
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form (using 16-cm diameter PMMA phantom)	51.29	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		0%
Dose Notification Value (mGy) as described in XR-29 (if applicable)		
DLP (mGy-cm)	=CTDIvol*17.5	893

[1]See definitions in the CT Accreditation Testing Instructions.

ACR CT ACCREDITATION DOSE SPREADSHEET

IMPORTANT NOTE: This Excel Workbook contains formulae essential to accurate reporting of dose for ACR CT Accreditation. It is intended to be used with both Windows and Mac operating systems. Please note, ANY alteration of the formulae will very likely result in errors of reported data, and could adversely affect our accreditation results. You must enter accurate data from this workbook into the ACRedit online testing package. Please check the results from this workbook against the results shown in the ACRedit database online testing package before submission.

Dose Calculator Spreadsheet (Exposure)

CTAP ID Number

Radiation Dosimetry (Adult Abdomen)

CTDI Body Phantom (32-cm diameter PMMA Phantom)	Measured	Calculated
kV	120	
mA	275	
Exposure time per rotation (s)	1	
# data channels used (N)[1]	16	
Z-axis collimation (T)[1]	1.25	
Axial (A): Table Increment (mm) = (I)[1] OR Helical (H):Table Speed (mm/rot) = (I)[1]	27.5	
Active Chamber length (mm)	100	
Chamber correction factor	1	
Center		
Measurement 1 (mR)	313.2	
Measurement 2 (mR)	311.8	
Measurement 3 (mR)	312.4	
Average of above 3 measurements (mR)		312.5
Body CTDI at isocenter in phantom (mGy)		13.6
12 o'clock position		
Measurement 1 (mR)	661.5	
Measurement 2 (mR)	659.1	
Measurement 3 (mR)	663.4	
Average of above 3 measurements (mR)		661.3
Body CTDI at12 o'clock position in phantom (mGy)		28.8
CTDIw (mGy)		23.71
Clinical exam dose estimates (using measured CTDIw and site's Adult Abdomen Protocol from Table 1)		
CTDIvol (mGy)	=CTDIw*N*T/I	17.25
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form (using 32-cm diameter PMMA phantom)	17.26	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		0%
Dose Notification Value (mGy) as described in XR-29 (if applicable)	35	
DLP (mGy-cm)	=CTDIvol*25	431
SSDE for 35 cm water equivalent diameter (mGy)	=SSDE(35 cm)	17.67

[1]See definitions in the CT Accreditation Testing Instructions.

ACR CT ACCREDITATION DOSE SPREADSHEET

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Dose Calculator Spreadsheet (Exposure)

CTAP ID Number

Radiation Dosimetry (Pediatric Head, 1 year old)

CTDI Head Phantom (16-cm diameter PMMA Phantom)	Measured	Calculated
kV	100	
mA	190	
Exposure time per rotation (s)	0.8	
# data channels *used* (N)[1]	16	
Z-axis collimation (T)[1]	1.25	
Axial (A): Table Increment (mm) = (I)[1] OR Helical (H):Table Speed (mm/rot) = (I)[1]	20	
Active Chamber length (mm)	100	
Chamber correction factor	1	
Center		
Measurement 1 (mR)	333.4	
Measurement 2 (mR)	335.9	
Measurement 3 (mR)	334.4	
Average of above 3 measurements (mR)		334.5
Head CTDI at isocenter in phantom (mGy)		14.6
12 o'clock position		
Measurement 1 (mR)	385.9	
Measurement 2 (mR)	387.6	
Measurement 3 (mR)	384.9	
Average of above 3 measurements (mR)		386.1
Head CTDI at 12 o'clock position in phantom (mGy)		16.8
CTDIw (mGy)		16.05
Clinical exam dose estimates (using measured CTDIw and site's Pediatric Head (1 year old) Protocol from Table 1)		
CTDIvol (mGy)	=CTDIw*N*T/I	16.05
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form (using 16-cm diameter PMMA phantom)	17.24	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		-7%
Dose Notification value as desciribed in XR-29 (if applicable)		
DLP (mGy-cm)	=CTDIvol*12	193

[1]See definitions in the CT Accreditation Testing Instructions.

ACR CT ACCREDITATION DOSE SPREADSHEET

IMPORTANT NOTE: This Excel Workbook contains formulae essential to accurate reporting of dose for ACR CT Accreditation. It is intended to be used with both Windows and Mac operating systems. Please note, ANY alteration of the formulae will very likely result in errors of reported data, and could adversely affect our accreditation results. You must enter accurate data from this workbook into the ACRedit online testing package. Please check the results from this workbook against the results shown in the ACRedit database online testing package before submission.

Dose Calculator Spreadsheet (Exposure)

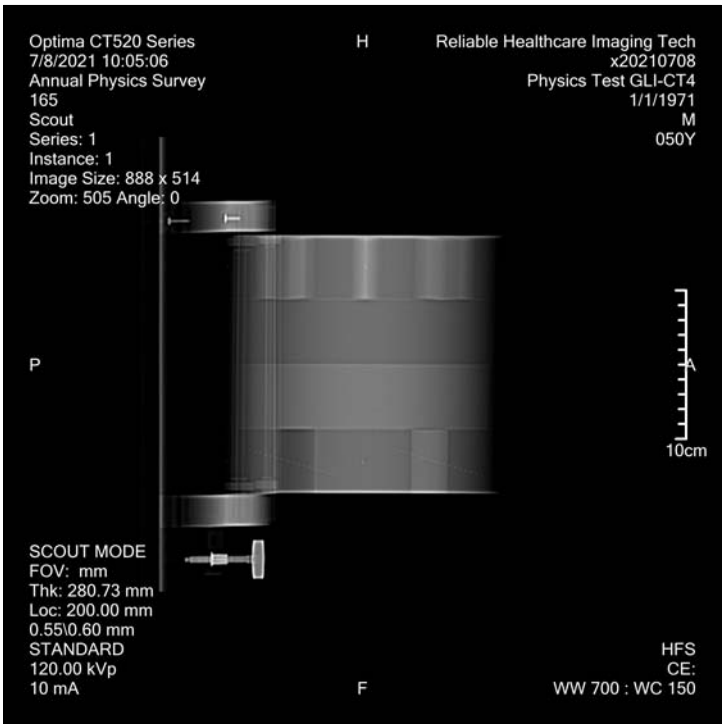
CTAP ID Number

Radiation Dosimetry (Ped Abdomen, 40-50 lb)

Note: For pediatric abdomen (40-50 lb.)protocols, some CT scanners report CTDIvol using the 16 cm phantom, while others use the 32 cm phantom. The physicist should use the phantom (16 or 32 cm) that is used by the scanner to report CTDIvol.

CTDI Phantom (16 or 32 cm diameter PMMA Phantom)	Measured	Calculated
Size of phantom the scanner uses to report CTDIvol for routine pediatric abdomen protocol (40-50 lb.)	**16 cm**	
kV	100	
mA	200	
Exposure time per rotation (s)	0.8	
# data channels *used* (N)[1]	16	
Z-axis collimation (T)[1]	1.25	
Axial (A): Table Increment (mm) = (I)[1] OR Helical (H):Table Speed (mm/rot) = (I)[1]	27.5	
Active Chamber length (mm)	100	
Chamber correction factor	1	
Center		
Measurement 1 (mR)	360.6	
Measurement 2 (mR)	360.5	
Measurement 3 (mR)	361.8	
Average of above 3 measurements (mR)		361.0
Ped Body CTDI at isocenter in phantom (mGy)		15.7
12 o'clock position		
Measurement 1 (mR)	426.36	
Measurement 2 (mR)	413.80	
Measurement 3 (mR)	415.77	
Average of above 3 measurements (mR)		418.6
Ped Body CTDI at12 o'clock position in phantom (mGy)		18.2
CTDIw (mGy)		17.38
Clinical exam dose estimates (using measured CTDIw and site's Pediatric Abdomen (40-50 lb.) Protocol from Table 1)		
CTDIvol (mGy)	=CTDIw*N*T/I	12.64
CTDIvol reported by scanner (mGy) for the protocol entered in the phantom site scanning data form	13.33	
Percent difference between calculated CTDIvol and CTDIvol reported by scanner		-5%
Dose Notification Value as described in XR-29 (if applicable)		
DLP (mGy-cm)	=CTDIvol*15	190
SSDE for 18.5 cm water equivalent diameter (mGy)	=SSDE(18.5 cm)	11.6

[1]See definitions in the CT Accreditation Testing Instructions.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Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
P
A
10cm
SCOUT MODE
FOV: mm
Thk: 280.73 mm
Loc: 200.00 mm
0.55\0.60 mm
STANDARD
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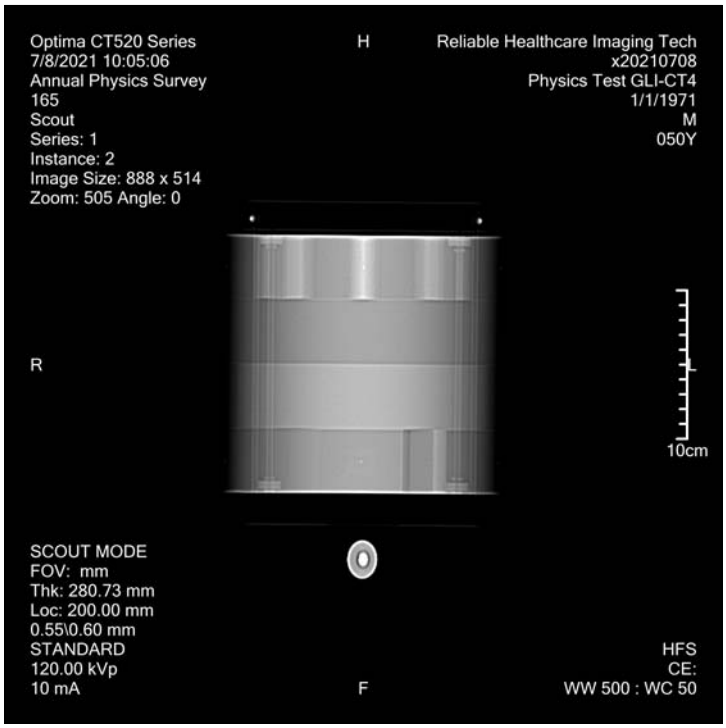
10 mA
F
HFS
CE:
WW 700 : WC 150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Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
10cm
SCOUT MODE
FOV: mm
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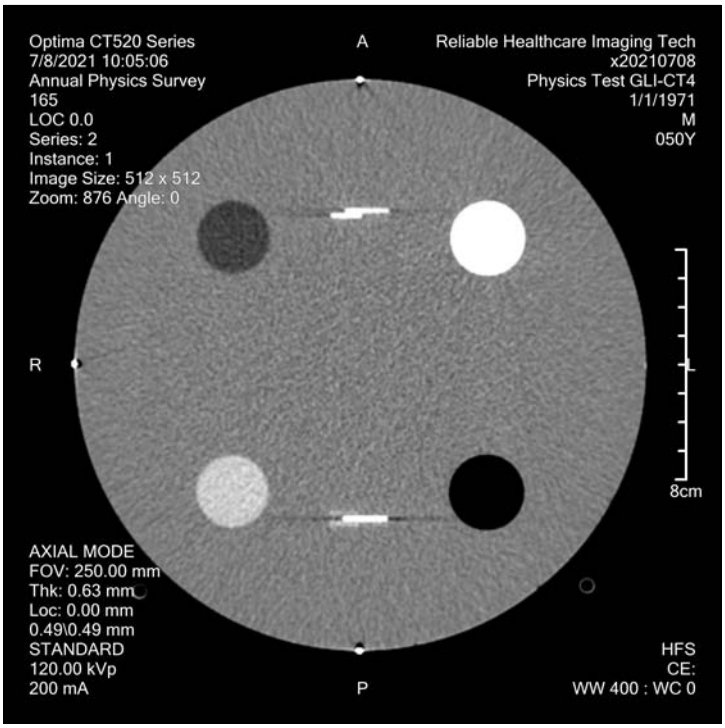
10 mA
F
HFS
CE:
WW 500 : WC 50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Reliable Healthcare Imaging Tech
x20210708
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1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 0.63 mm
Loc: 0.00 mm
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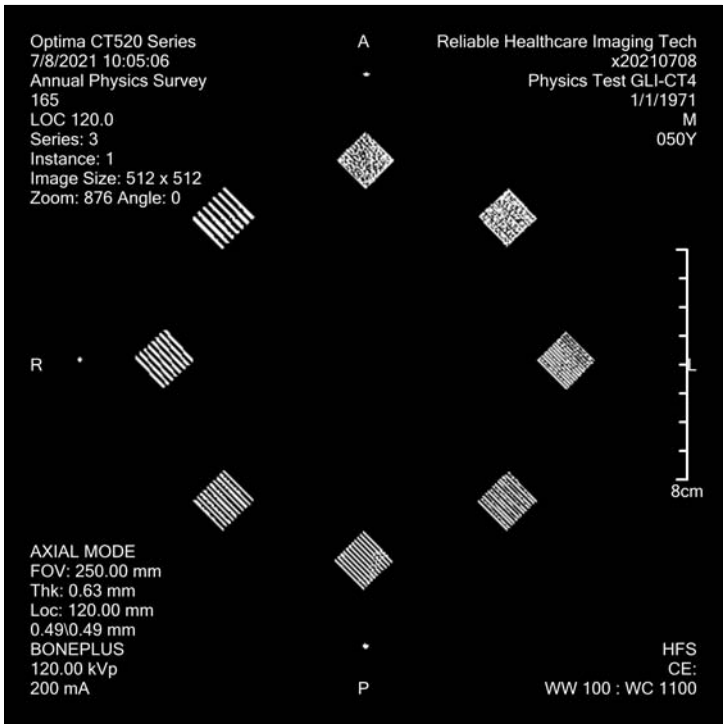
200 mA
P
HFS
CE:
WW 400 : WC 0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1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 0.63 mm
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200 mA
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CE:
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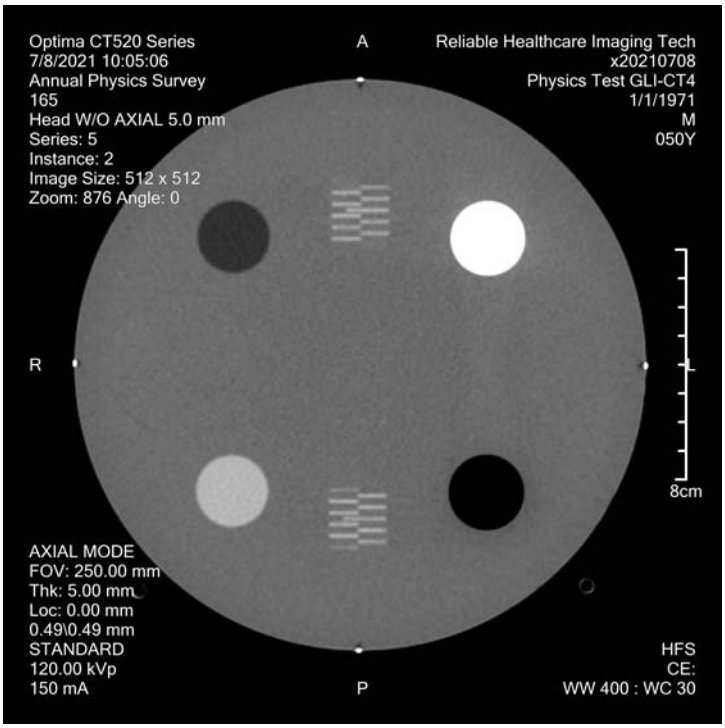
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Zoom: 876 Angle: 0
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Reliable Healthcare Imaging Tech
x20210708
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1/1/1971
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050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
Loc: 0.00 mm
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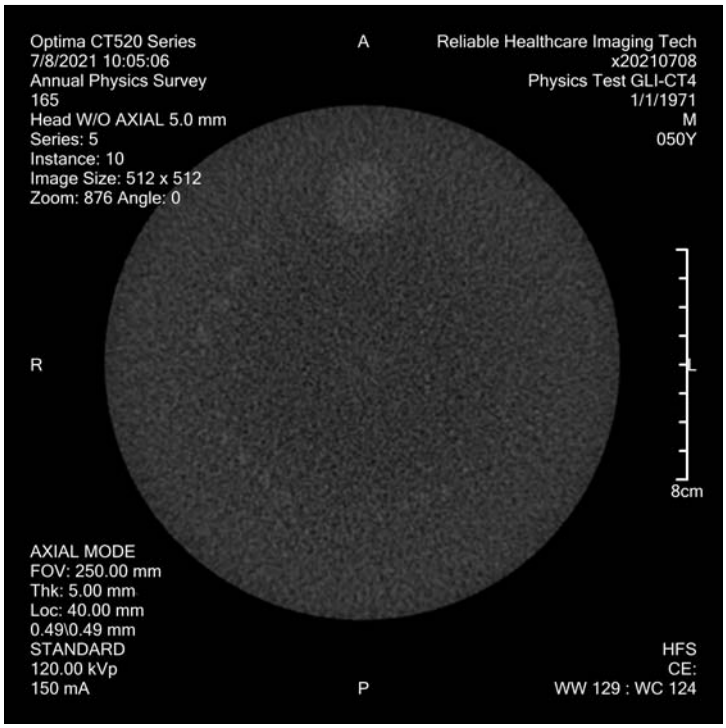
150 mA
P
HFS
CE:
WW 400 : WC 30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Zoom: 876 Angle: 0
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Reliable Healthcare Imaging Tech
x20210708
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1/1/1971
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050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
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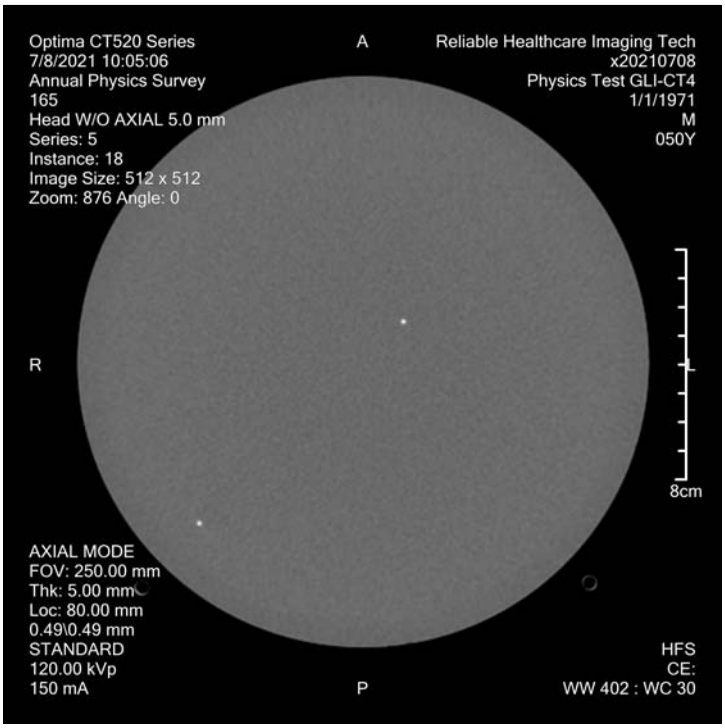
150 mA
P
HFS
CE:
WW 129 : WC 124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Zoom: 876 Angle: 0
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Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
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FOV: 250.00 mm
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Loc: 80.00 mm
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150 mA
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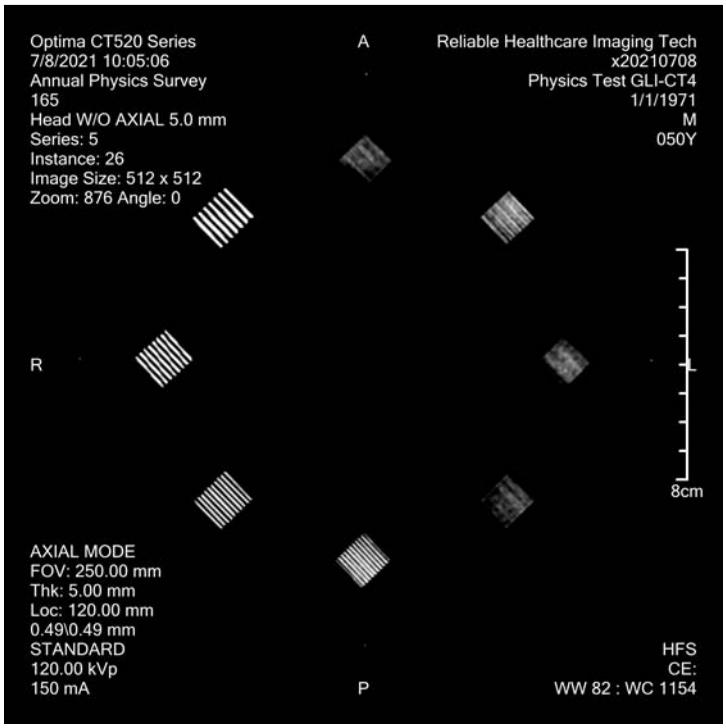
CE:
WW 402 : WC 30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Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
Loc: 120.00 mm
0.49\0.49 mm
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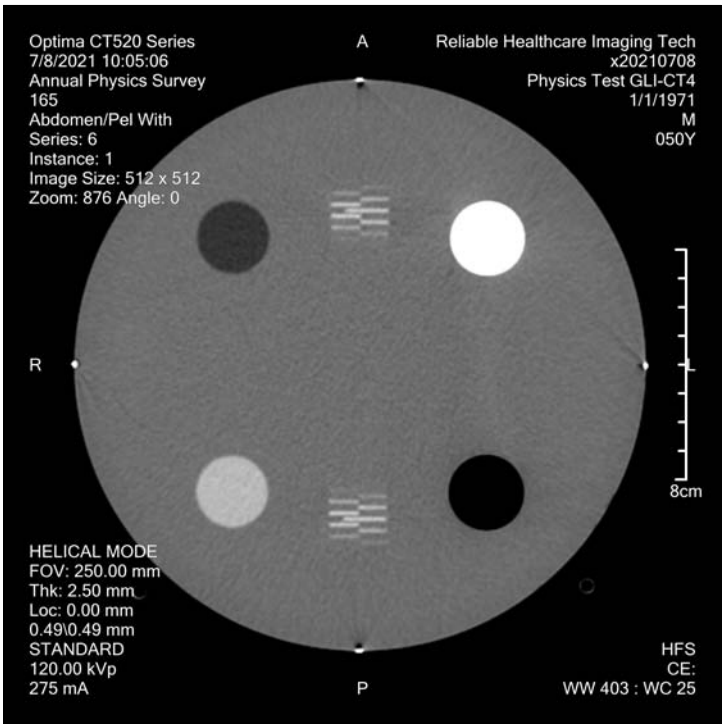
150 mA
P
HFS
CE:
WW 82 : WC 1154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Abdomen/Pel With
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A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
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275 mA
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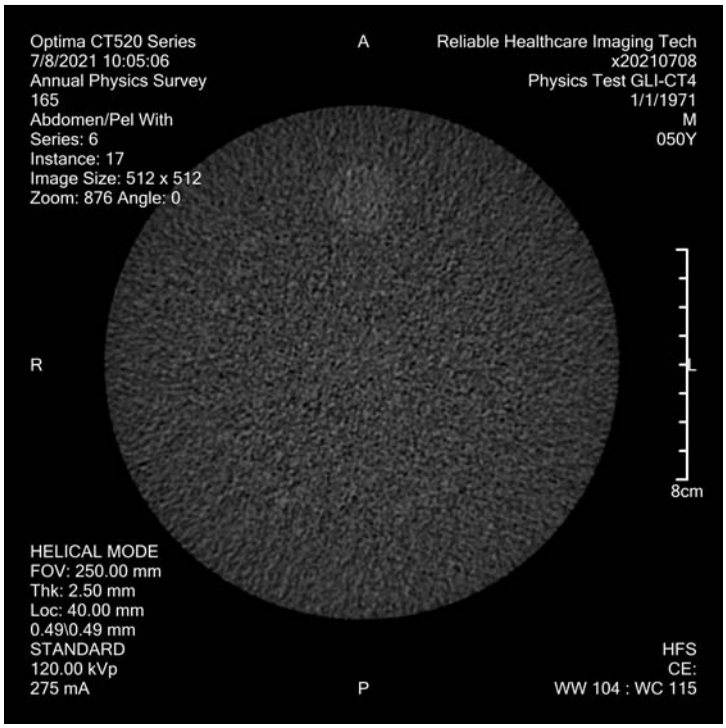
WW 403 : WC 25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Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
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275 mA
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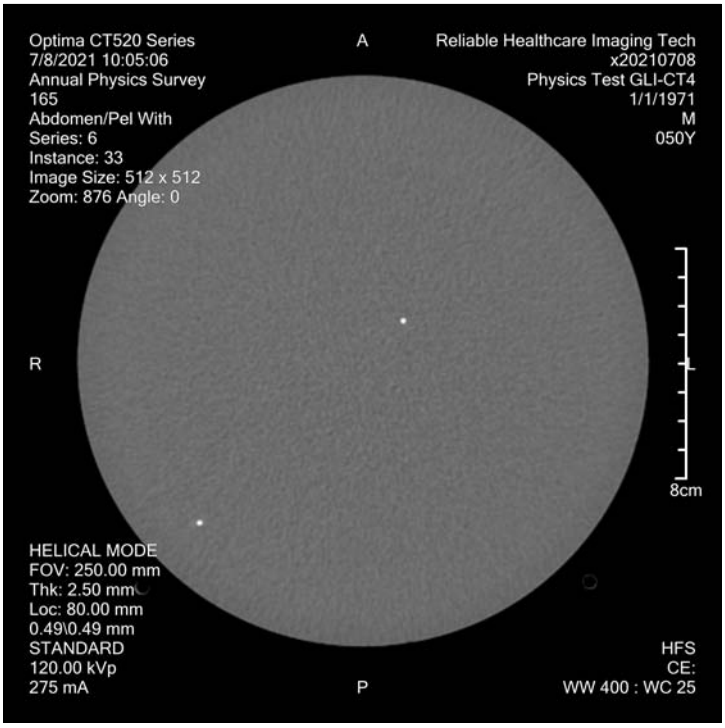
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Annual Physics Survey
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A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
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275 mA
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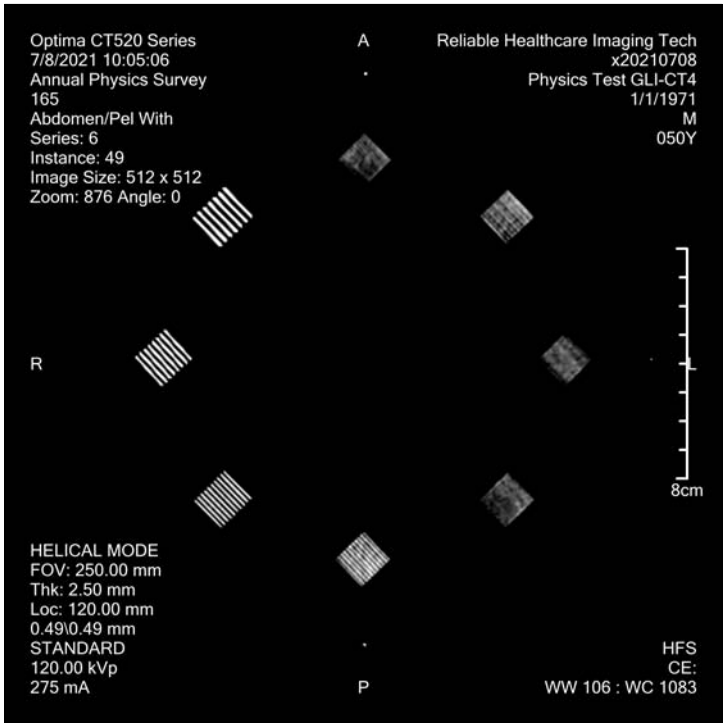
CE:
WW 400 : WC 25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Abdomen/Pel With
Series: 6
Instance: 49
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A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
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0.49\0.49 mm
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120.00 kVp
275 mA
P
HFS
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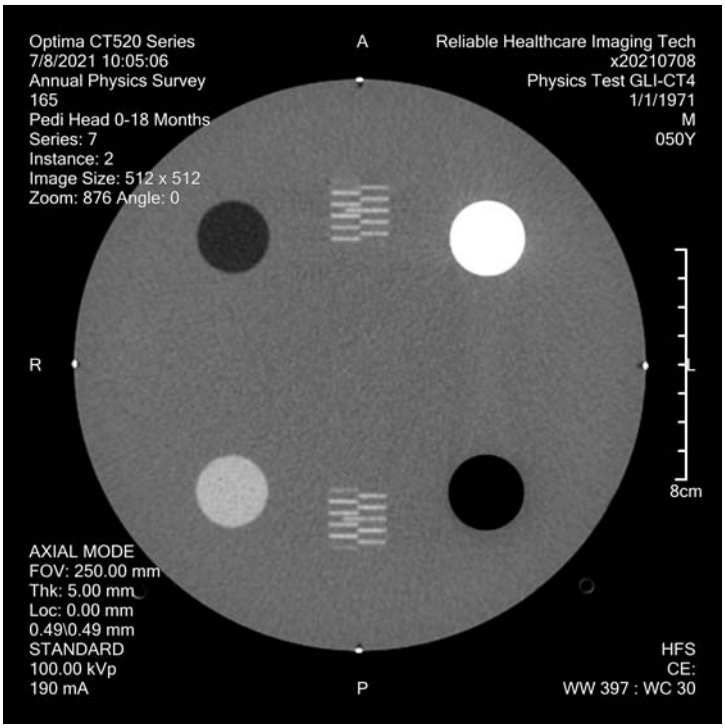
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Pedi Head 0-18 Months
Series: 7
Instance: 2
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
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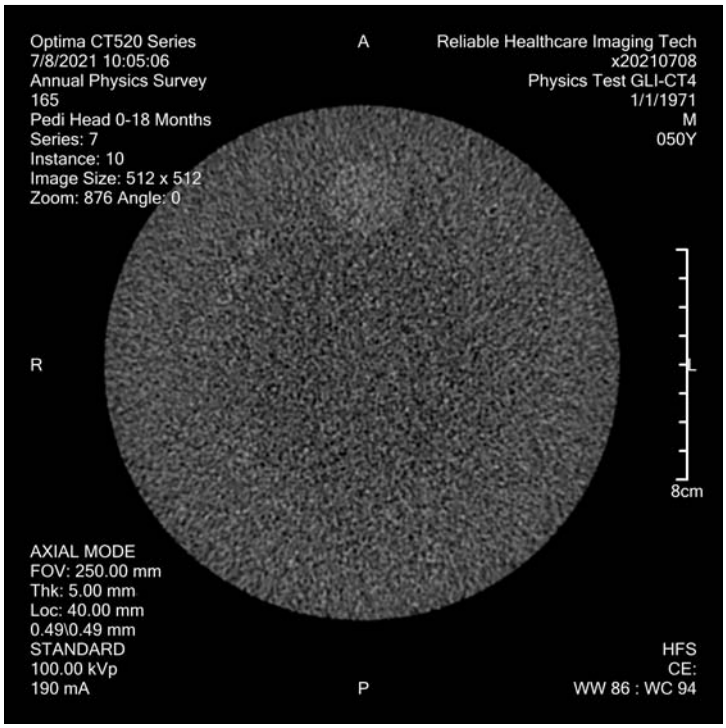
0.49\0.49 mm
STANDARD
100.00 kVp
190 mA
P
HFS
CE:
WW 397 : WC 30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Pedi Head 0-18 Months
Series: 7
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Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
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0.49\0.49 mm
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190 mA
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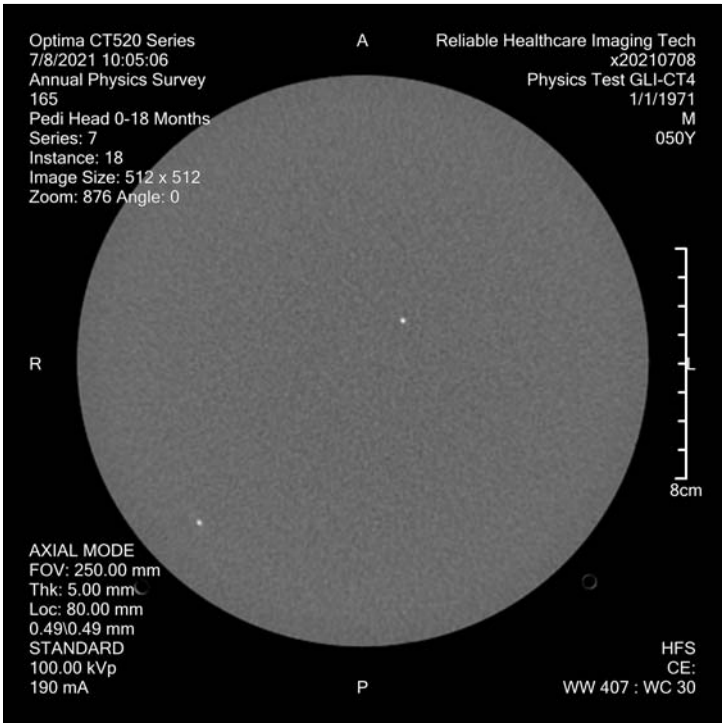
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Series: 7
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A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 5.00 mm
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0.49\0.49 mm
STANDARD
100.00 kVp
190 mA
P
HFS
CE:
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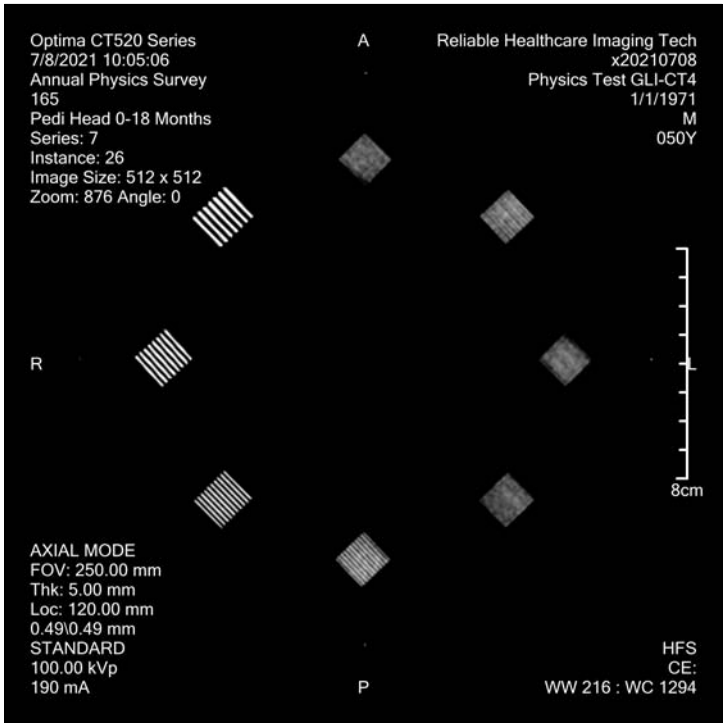
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Pedi Head 0-18 Months
Series: 7
Instance: 26
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
AXIAL MODE
FOV: 250.00 mm
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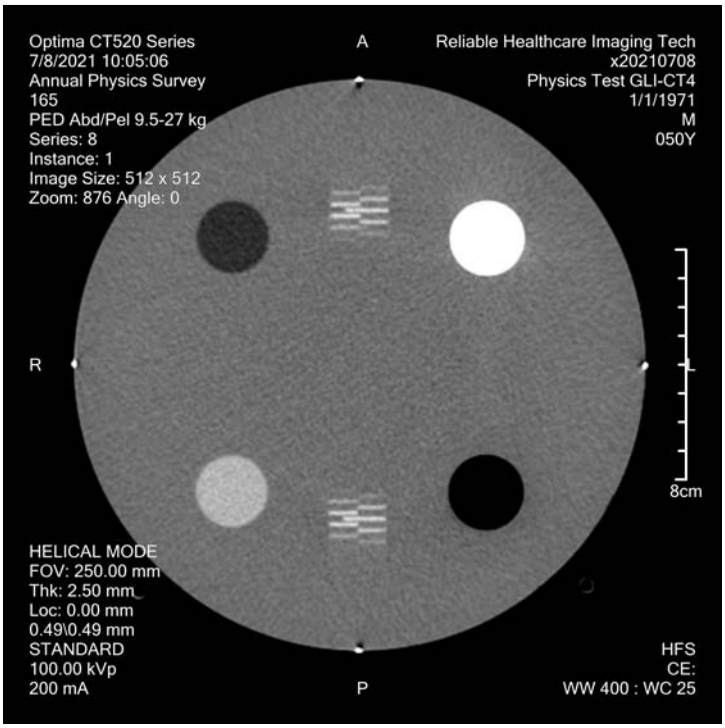
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PED Abd/Pel 9.5-27 kg
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Zoom: 876 Angle: 0
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Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
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0.49\0.49 mm
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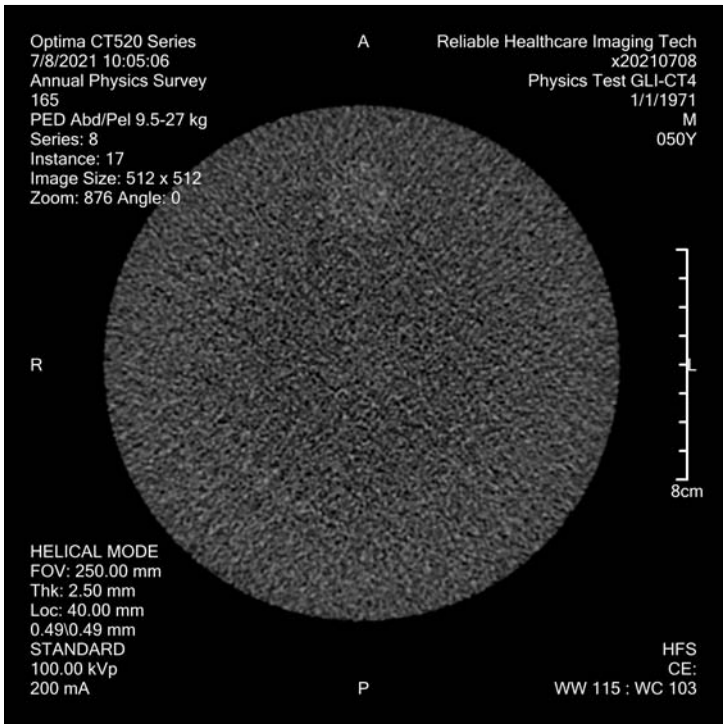
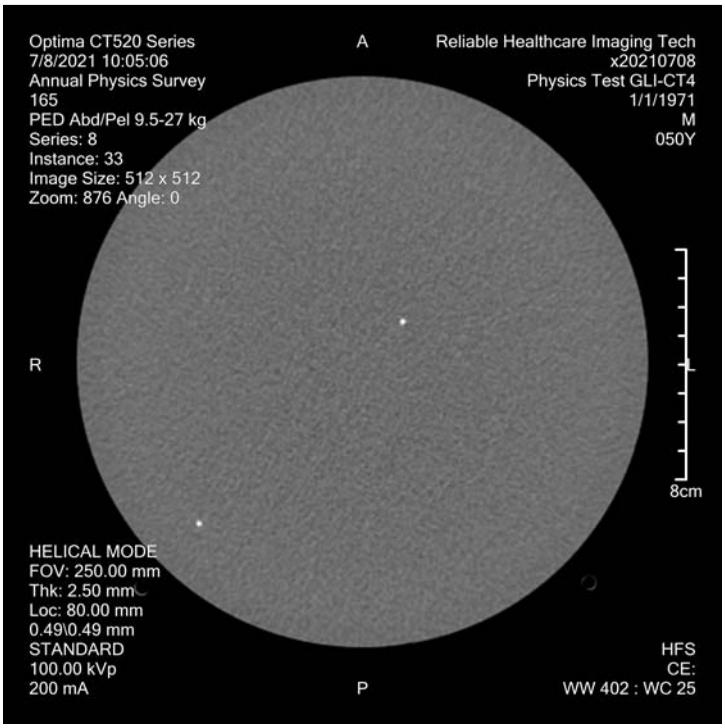
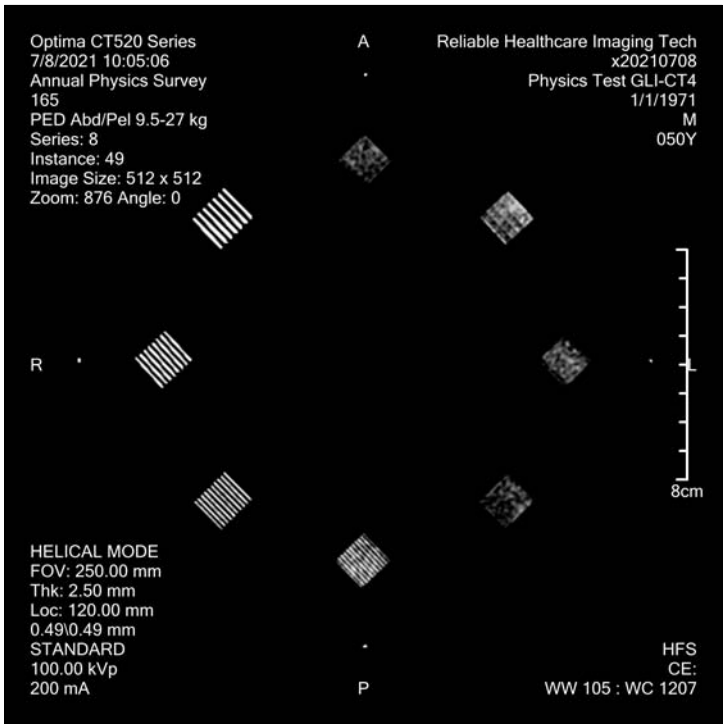
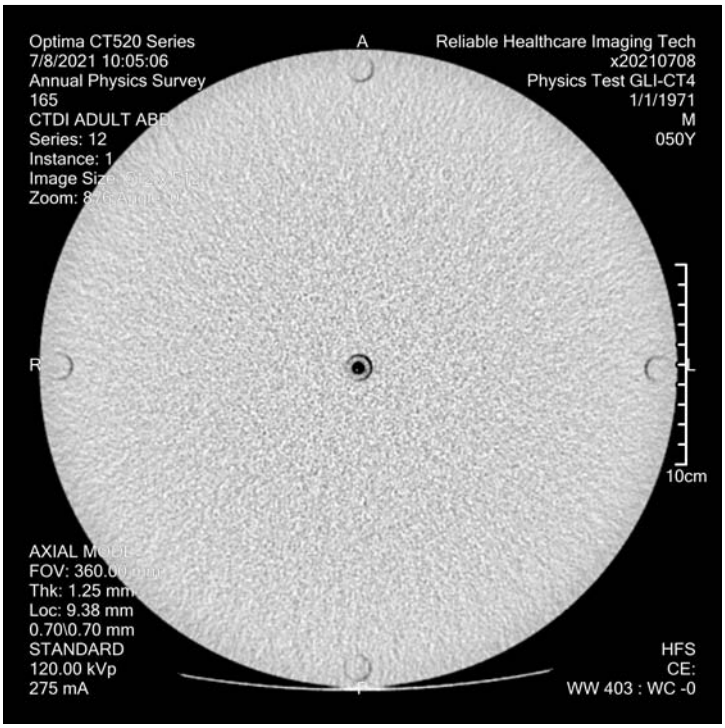
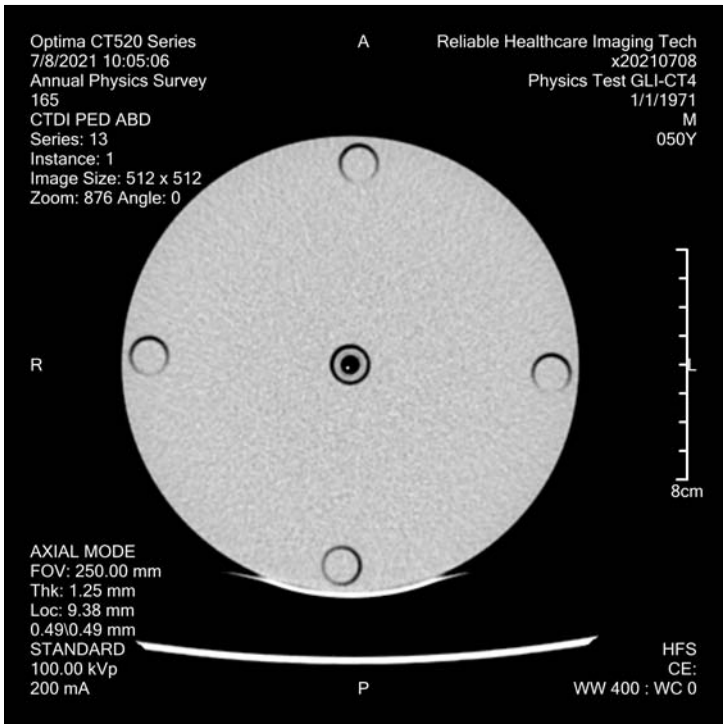
100.00 kVp
200 mA
P
HFS
CE:
WW 400 : WC 25

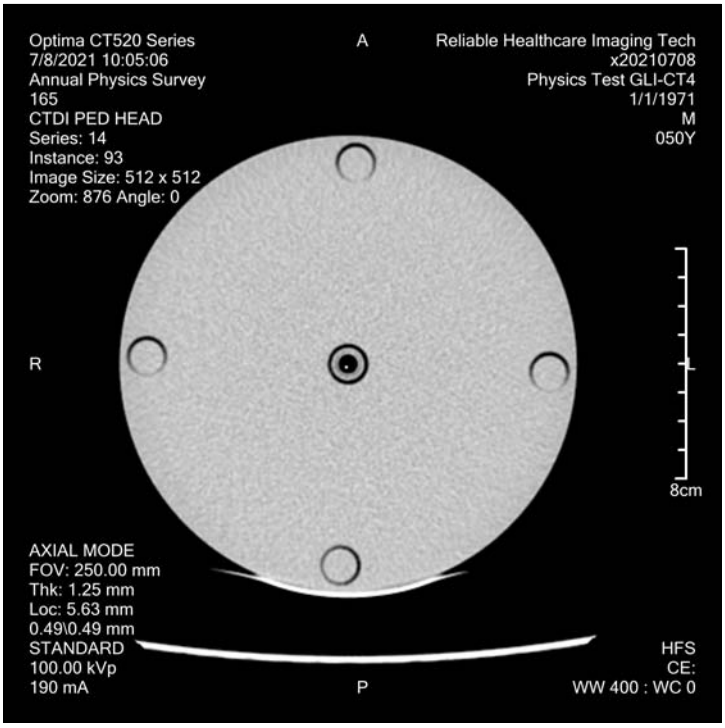

Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
PED Abd/Pel 9.5-27 kg
Series: 8
Instance: 17
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
Loc: 40.00 mm
0.49\0.49 mm
STANDARD
100.00 kVp
200 mA
P
HFS
CE:
WW 115 : WC 103

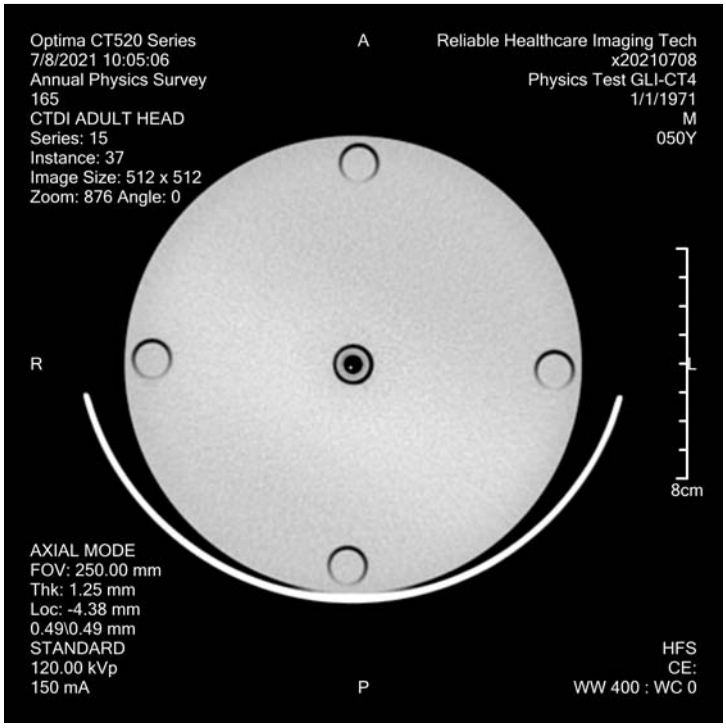

Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
PED Abd/Pel 9.5-27 kg
Series: 8
Instance: 33
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
Loc: 80.00 mm
0.49\0.49 mm
STANDARD
100.00 kVp
200 mA
P
HFS
CE:
WW 402 : WC 25


Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
PED Abd/Pel 9.5-27 kg
Series: 8
Instance: 49
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
8cm
HELICAL MODE
FOV: 250.00 mm
Thk: 2.50 mm
Loc: 120.00 mm
0.49\0.49 mm
STANDARD
100.00 kVp
200 mA
P
HFS
CE:
WW 105 : WC 1207


Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
CTDI ADULT ABD
Series: 12
Instance: 1
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
L
10cm
AXIAL MODE
FOV: 360.00 mm
Thk: 1.25 mm
Loc: 9.38 mm
0.70\0.70 mm
STANDARD
120.00 kVp
275 mA
HFS
CE:
WW 403 : WC -0


Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
CTDI PED ABD
Series: 13
Instance: 1
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
L
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 1.25 mm
Loc: 9.38 mm
0.49\0.49 mm
STANDARD
100.00 kVp
200 mA
P
HFS
CE:
WW 400 : WC 0


Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
CTDI PED HEAD
Series: 14
Instance: 93
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
L
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 1.25 mm
Loc: 5.63 mm
0.49\0.49 mm
STANDARD
100.00 kVp
190 mA
P
HFS
CE:
WW 400 : WC 0


Optima CT520 Series
7/8/2021 10:05:06
Annual Physics Survey
165
CTDI ADULT HEAD
Series: 15
Instance: 37
Image Size: 512 x 512
Zoom: 876 Angle: 0
A
Reliable Healthcare Imaging Tech
x20210708
Physics Test GLI-CT4
1/1/1971
M
050Y
R
L
8cm
AXIAL MODE
FOV: 250.00 mm
Thk: 1.25 mm
Loc: -4.38 mm
0.49\0.49 mm
STANDARD
120.00 kVp
150 mA
P
HFS
CE:
WW 400 : WC 0