fraserhealth Better health. Best in health care. · Providence Health Care How you want to be treated. · Provincial Health Services Authority Province-wide solutions. Better health. · Vancouver CoastalHealth	Document Number
Standard Operating Procedure **Daily CT QC Phantom Test – GE RevFrontier**	ABCD-21-16-90181

SITE APPLICABILITY:

All Medical Imaging (MI) sites in Fraser Health (FH), Providence Healthcare (PHC), Provincial Health Services Authority (PHSA), and Vancouver Coastal Health (VCH).

PURPOSE:

To ensure consistent image quality over the CT scanner system's lifetime and to establish and maintain a regular Quality assurance (QA) program.

To comply with the Diagnostic Accreditation Program (DAP) standard for Daily CT QC testing.

SCOPE:

Applicable to sites with a GE Revolution Frontier 64-slice CT scanner.

RESPONSIBILITIES:

The CT department (CT technologist) at the site will perform the Daily QC and ensure that a water phantom is scanned under a prescribed set of conditions:

- Ensure that the mean CT number falls within the range of the manufacturer's specifications.
- Ensure that the standard deviation representing image noise and the calculations for image uniformity are within acceptable parameters.
- Repeat this test on a daily basis to detect changes in image quality values before the problem becomes visible. This fully replaces the Weekly Phantom test.
- Perform a "Checkup" scan or "FastCal" if it was last performed more than 12 hours ago.
- Ten Baseline QC scans must be performed by the site's CT technologists when specifically requested to do so by the physicist or a quality coordinator. This would occur when QC data does not fall within acceptable parameters in the 2 weeks following the replacement of CT imaging components. (tube, detector, collimator, etc.)

The CT Technologist will record baseline data (when required) and subsequent QC data in the **Daily** QC logbook and record on the Medical Imaging (MI) Quality [HealthBC] SharePoint site specific CT folder.

The CT technologist will compare the subsequent QA results from Daily QC against the baseline results.

- If degradation in image quality/obvious artifacts, failing noise and uniformity calculations, or CT number outside of the manufactures specifications is observed, contact radiology service.
- Early intervention could prevent a major breakdown and/or negative impacts to patient care.

Standard Operating Procedure

Daily CT QC Phantom Test – GE RevFrontier

REQUIREMENTS:

Personnel required: 1	Phantom Weight: 4 kg (8.8 lbs)
Task	**Estimated time (minutes)**
Phantom setup time	2
Acquisition time	2
Analysis/ Recording time	If Passes, ~ 4 minute / If Fails, ~ 6 minutes
Dismantle phantom setup	2
Total Time	**10 - 12 minutes**

PROCEDURE:

Tools and Test Equipment

Water Phantom: 20 cm water

Phantom holder bracket

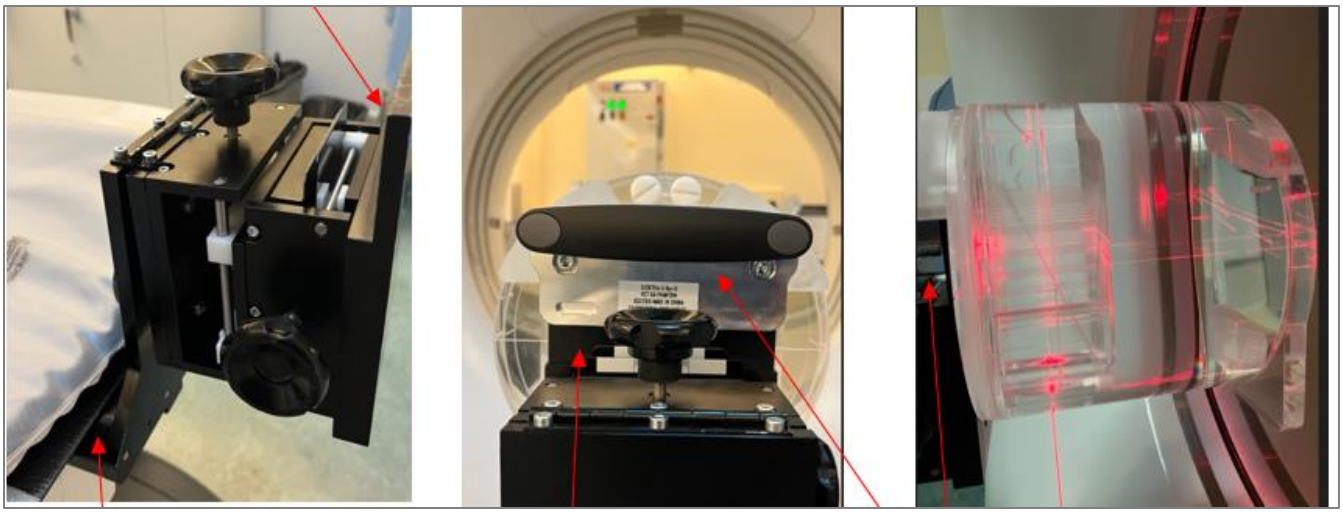


Table bracket **Phantom holder bracket** **Metal Phantom bracket-fits over holder bracket**

Adhere to the following guidelines when handling or positioning the water phantom.

- Visually inspect the water phantom and phantom holder for damage before each use. If damaged, do not use the broken piece. Have it replaced immediately.
- The phantom bracket on the water phantom, used to support it on the phantom holder, is not a handle. It should not be used to hold or carry the phantom. While transporting the water phantom, carry it securely with both hands to avoid dropping it. A damaged phantom can potentially cause injury.

- The phantom bracket is meant to have a snug fit on the phantom holder. This minimizes motion during scanning, which could lead to false failures in the QA images. The snug fit requires the user to take care when positioning or removing the water phantom from the phantom holder.

Procedure

Daily Quality Control scans should be done after the daily start up (reboot), tube warmup, and system calibrations (fast cal).

1. Position the Water Phantom

1.1 Place the phantom on the phantom holder, and level it.

1.2 Turn the knob facing the cradle clock-wise to tilt the top of the phantom AWAY from the gantry.

1.3 Use the laser alignment lights to position the phantom (see ***Figure 2***):

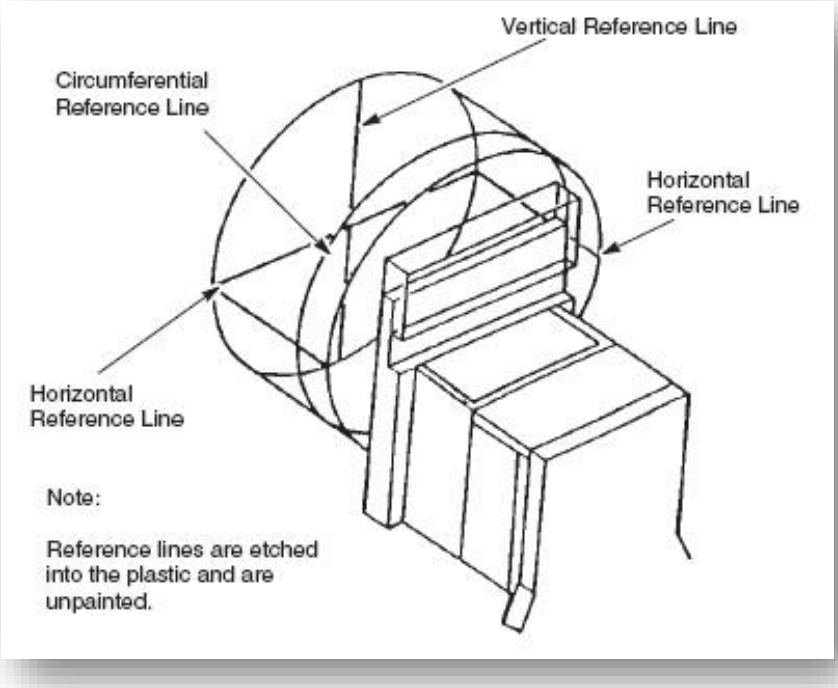
a. Align the axial light to the circumferential line marking Section 1.

b. Align the coronal light to the horizontal lines on either side of the phantom.

c. Align the sagittal light (where it strikes the top of the phantom) to the vertical line on the top of the phantom.

d. Position the phantom and select.

Figure 2. ***Phantom reference lines***



2. Prescribe the QA Series for the Daily CT Number, Noise, Uniformity, and Artifact Tests

2.1 Select the scheduled test from the worklist to display the Patient/Exam Parameters screen.

2.2 Exam Description: Enter up to 22 characters to describe the test ie: tech initials (Recommended)

2.3 On the Anatomical Protocol selection screen, choose **Service**-tab at the top.

2.4 Select **Image Quality**

2.5 Select protocol **LMMI Daily CT QC**

2.6 **Ensure any Auto-push function is set to off.**

3. If your facility hasn't created a Daily QA protocol, use the following parameters to finish the QA series prescription:

On the **Helical View Edit screen** select the following parameters:

Table 1: Parameters for QA *Protocol Name = **LMMI Daily CT QC**

Interface	Input
Entry	Head First
Position	**Supine**
Anatomical Reference	**QA**
Scan Range	**S40 – S80**
Thickness	**5 mm**
Detector Coverage	**40 mm Aperture**
Recon Interval	**5 mm**
Tilt	**0 degrees**
Scan FOV	**Small Body**
kV	**120**
mA	**335**
Scan Type	**Helical**
Rotation Speed	**0.4** second
Pitch	**0.516**
Scan Range	Prescribe **1 scan group with 1 recon**
Contrast	**None**
Special Processing	*None*
Matrix	**512**
DFOV	**25 cm**
Kernel	**Standard**
ASiR	**None**
Default Window Level	**60**
Default Window Width	**400**

4. Analyze the QA Images

4.1 Display the reconstructed water phantom images of the helical scan and perform analysis as described in the following sections.

4.2 Perform the following:

a. **CT Number, Noise and Uniformity tests** at scan location S60 of the helical scan. See instructions in section 5.

b. **Artifact test**: Inspect all reconstructed images for any obvious **artifacts.** See instructions in section 6 and 8.2.

4.3 Record the data from the tests in the corresponding columns of the QC log sheet.

4.4 Repeat the entire procedure if either the CT number, Noise and Uniformity or Artifact tests fail, and ensure the correct phantom positioning and protocol has been used.

Record the failed and repeated data on the log sheet

4.5 If a test fails again, report the failure to the supervisor and site coordinator.

4.6 Follow facility procedures to notify radiology service.

5. CT Number, Noise, and Uniformity of Water tests

Water Phantom test for CT number, noise and uniformity (**Figure 3**). Use scan location S60 (Recon1)

Use the **Standard** algorithm to reconstruct the image.

Refer to **Figure 3**.

5.1 Select **Erase** to remove previous ROI data.

5.2 Select **Measurements**

5.3 Select **Grid** overlay. Precisely center the grid vertically and horizontally.

5.4 Select **Box ROI** to position a 400 mm^2 ± 20 mm box ROI over the center of the image.

5.5 Record the center ROI mean CT number, and Standard deviation (Noise) in the QC logsheet.

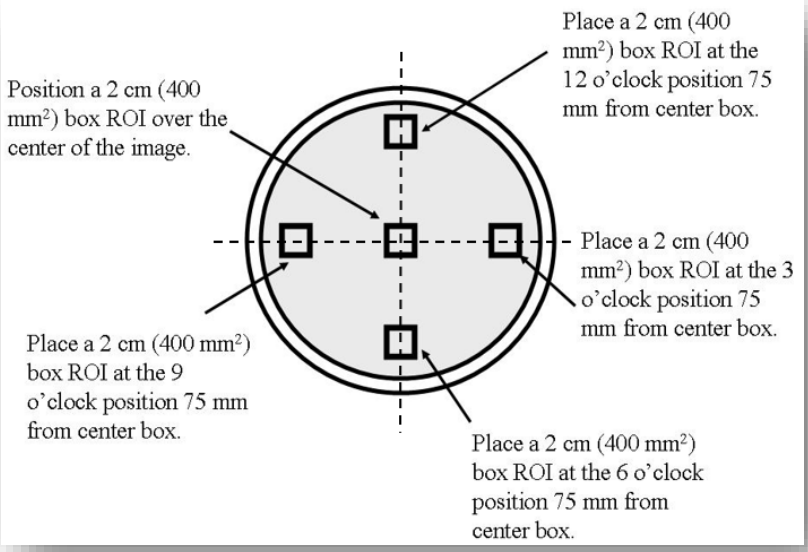
5.6 Select **Box ROI** and move the cursor to the 12 o'clock position (**75 mm** from Center ROI's center to the 12 o'clock ROI's center).

5.7 Record that mean CT number on the QC log sheet on MI Quality site.

5.8 Repeat step 5, 6 and 7 for each of the 3, 6 and 9 o'clock positions.

*Note: *Uniformity = the absolute difference between the CT numbers from the Centre ROI and the each of the 12, 3, 6 and 9 o'clock ROIs*

Figure 3: ***CT Number, Noise, Uniformity section***



6. Artifact Test

6.1 Assess all reconstructed phantom images for obvious artifacts.

6.2 Record in Daily QC and room checklist on MI Quality site.

7. Finalization

7.1 Close any image files still open on the screen.

7.2 Save to PACS, only those images that have obvious artifacts.(Ensure that auto-push is not on)

7.3 Remove the phantom from the system bore and return to storage location.

7.4 Record all data on both the MI quality site log sheet, and QC room checklist.

7.5 Take exam to **Completed** status in PACS (if required) and then RIS.

8. Typical Results and Allowable Variations

GE expects the standards of allowable variation in image quality parameters to vary with the installation and image evaluator(s).

Ensure the prescribed technique was used, then follow the facility guidelines to inform service when the variations reach the specified maximum deviation as indicated by the logsheet or observations.

8.1 CT Number, Noise and Uniformity of water

When imaging and analyzing the water section of the phantom is performed correctly, the following should be seen:

- CT number of the center ROI within the range of **0 ± 3 HU,** meeting GE's specifications.

- Standard deviation (Noise) of the center ROI should not vary from the baseline by more than **0.2 HU.**
- Uniformity within the allowable range of **2 HU** from the established acceptance baseline values.

8.2 Phantom Image Artifacts

Because the human eye determines clinical image quality, it remains subjective and difficult to define.

No obvious artifacts should be visible when viewing the reconstructed image with standard window width and window level.

Examples of artifacts that are serious enough to be reported to radiology service are shown in *Figures 4 and 5* below.

Figure 4: ***Cupping Artifact***

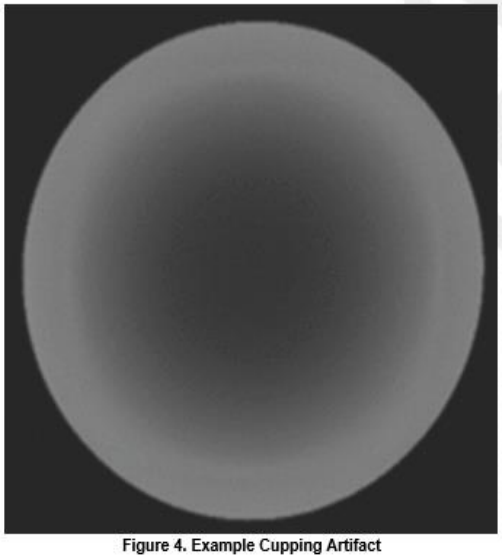


Figure 4. Example Cupping Artifact

Figure 5: ***Ring Artifact***

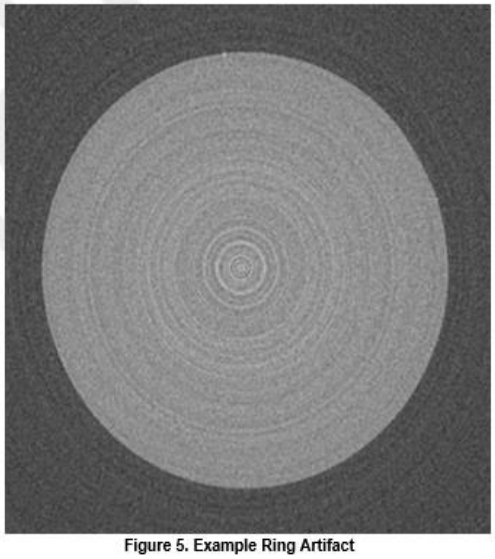


Figure 5. Example Ring Artifact

REFERENCES/ASSOCIATED DOCUMENTS:

Diagnostic Accreditation Program Accreditation Standards – Diagnostic Imaging
https://www.cpsbc.ca/accredited-facilities/dap/accreditation-standards-DI

QA Manual = 5786711-1EN Rev 6 (Jan2019) GE Healthcare Revolution Frontier
Technical Reference Manual (basis for this procedure

Standard Operating Procedure

Daily CT QC Phantom Test – GE RevFrontier

First Released Date:	07-JUL-2023			
Posted Date:	05-MAR-2024			
Last Revised:	23-FEB-2024			
Last Reviewed:	23-FEB-2024			
Approved By:	Medical Physicist Lead, MI			
	25-OCT-2022			
Owners:	Regional Quality Coordinator, MI			
Revision History:	**Version**	**Date**	**Description/ Key Changes**	**Revised By** (Name and Position)
	1.0	25-OCT-2022	Initial release	Cheryl Mason, Quality Coordinator
	2.0	07-JUL-2023	Distinguish QA/Water phantom terminology	Cheryl Mason, Quality Coordinator
	3.0	05-MAR-2024	Revise responsibility section, Change QA to Water phantom, Change 10% to 0.2HU, Change WW and WL from default to standard	Cheryl Mason, Quality Coordinator