





“The New ACR 2018 Digital Mammography QC Manual: An Overview and Early Adopter Perspectives.”

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Disclosures



- Phantom Image Reviewer for the ACR Mammography Accreditation Program


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Learning Objectives



Upon completion of the talk, the attendee will be able to:

1. Identify if the 2018 QC Manual is appropriate for your facility by assessing its pros and cons.
2. Identify the challenges and solutions of the Consulting physicists.


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Outline

- Advising the site on adoption of the manual
- Communication with the Radiologist
- Establishing Technologist QC program
- Implementing physics testing
- MP involvement post adjustments, changes or repairs


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Advising the Site on Adoption of the Manual

- The 2016 Digital Mammography QC manual-only covered FFDM and CR
 - Most sites were adding DBT at this time. Since you could not use this manual for DBT, very few switched.
- The 2018 Mammography QC manual – covered FFDM, CR and DBT
 - This now can be applied to most sites
- Prerequisites
 - Must have ACR FFDM Phantom
 - Must have Annual Physics evaluation prior to starting


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Advising the Site on Adoption of the Manual

<p>Pros</p> <ul style="list-style-type: none"> • Unifies QC programs of multiple vendors • Physicist testing is more efficient • Technologist QC is more efficient • Clarifies some gray areas of Physicist onsite vs. oversight • New Phantom has tighter manufacturing tolerances and less artifact due to attenuation differences 	<p>Considerations</p> <ul style="list-style-type: none"> • Must purchase new Phantoms • Must have physics evaluation prior to implementation of the new QC program • Everyone must learn new program and adapt it to your site's equipment • Uncertainty in interpretation for regulators and physicists
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Advising the Site on Adoption of the Manual

Types of Facilities

- Single Manufacturer Same Units
 - Not many benefits with new manual
- Single Manufacturer Multiple Generations
 - Some benefits with new manual
- Multiple Manufacturers
 - Great benefits with new manual
- Additional Functionality – Contrast Enhanced Spectral Mammography ★
 - Not a deal breaker with new manual. The FAQs specify that the manufacturer’s QC program can be used for CEM and ACR manual for DBT and FFDM portions.

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Advising the Site on Adoption of the Manual

Challenges of the Consulting Physicist:

- Remote access to facilities
- Communication with Technologist and Radiologists
- Wide range of equipment
- Different size facilities
- Implementation Schedule
 - Mammography Units
 - Review Workstations (On-site or Remote)
 - Laser Imagers (On-site or Remote)

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Communication with the Radiologist

- According to the ACR 2018 QC manual the Lead Interpreting Physician(LIP) is responsible for the ensuring all MQSA required activities are met. ★
- Follow up after MEE and Annual Surveys
 - Onsite if available-verbally
 - Facility QC Letter for Radiologist- Summarizes findings for Radiologist and can be left onsite
 - E-mail follow up is recommended

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2018 ACR DM QC Manual p.246

2018 ACR DM QC Manual p.247

Communication with the Radiologist

- Quality Assurance Committee (QAC)
 - QAC can provide oversight to the QC program, set goals and direction, determine policy, and assess effectiveness of the QC program
 - Committee should include:
 - Lead Radiologist, additional Radiologist
 - Medical Physicist
 - Facility Manager
 - QC Technologist
 - Supervising Technologist
 - Additional Radiology Personnel involved in mammography patient care
 - This QC manual requires quarterly review of the facility QC by LIP and Facility Manager. More frequent if problems are noted. They must fill out the “Facility QC Review” Form

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Establishing Technologist QC Program

Considerations for Training the Technologist:

- The Physicist is Applications
 - Must instruct the QC Technologist(s) on all new QC procedures specific to the site's equipment
 - Need to allot time on-site
 - The QC Technologist(s) must be present
 - Review the new instructions for Medical Physicist Involvement in equipment adjustments, changes, or repairs
 - Explain Mobile QC if applicable

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Establishing Technologist QC Program

Training the Technologist: (cont.)

- ACR Technique and Procedures forms

Note: During the MEE, the medical physicist should complete the Technologist's ACR Technique and Procedure Summaries form (located in the Technologist Section) to help the QC technologist use the appropriate techniques during routine QC. This form should be reviewed and updated as necessary during annual surveys.

2018 ACR DM QC Manual p.123

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ACR Technique and Procedure Summaries

Facility: Image Mode: Room ID:

ACR Phantom Image Quality

Procedure:

Item	Pass	Fail
Field size (1) and		
Field size (2) and		
Field size (3) and		
Field size (4) and		
Field size (5) and		
Field size (6) and		
Field size (7) and		
Field size (8) and		
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Field size (10) and		
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Field size (45) and		
Field size (46) and		
Field size (47) and		
Field size (48) and		
Field size (49) and		
Field size (50) and		

ACR Technique and Procedure Summaries (cont)

Facility: Image Mode: Room ID:

ACR & RTR Number QC

Procedure:

2018 ACR DM QC Manual p.103

2018 ACR DM QC Manual p.104

ACR Technique and Procedure Summaries (cont)

Facility: Image Mode: Room ID:

ACR & RTR Number QC

Procedure:

Item	Pass	Fail
Field size (1) and		
Field size (2) and		
Field size (3) and		
Field size (4) and		
Field size (5) and		
Field size (6) and		
Field size (7) and		
Field size (8) and		
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Field size (48) and		
Field size (49) and		
Field size (50) and		

2018 ACR DM QC Manual p.105

Establishing Technologist QC Program

- ACR Phantoms for Scoring
 - Review scoring the new ACR phantom
 - No deductions
 - Different Pass/Fail Criteria
 - Artifacts Fail - train technologist on what is a "clinically significant" artifact
 - Discuss ACR phantom submissions
 - Isolating a phantom image
 - Approved file formats
 - Review online instructions
- Responding to Questions
 - Expect to follow up and provide ongoing support

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Outline

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Implementing Physics Testing

- Initial annual survey
 - Must set baselines
 - Must determine applicable tests for facility
 - Must document the setup well for consistency
 - Fill out “Procedure” blocks on ACR forms
 - Manufacturer specific tests and action limits may still be useful for acceptance testing or troubleshooting.

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Implementing Physics Testing

- Initial Annual Survey (Cont.)
 - “If Applicable” Tests
 - Computed Radiography
 - Film Printer
 - Manufacturer Calibrations
 - Optional Tests (MEE and Troubleshooting)
 - Collimation (Except for DBT)
 - Ghosting
 - Beam Quality (HVLs)
 - kVp accuracy and reproducibility
 - Viewbox illuminance

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Implementing Physics Testing

- Remember:
 - *“Applicable 2D tests must be performed whether or not the system is used for 2D imaging since they test system components which may impact DBT performance.”*
 - *“If the DBT system employs an “add-on” device, applicable 2D tests must be repeated with the “add-on” device in place.”*

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Implementing Physics Testing

- Hologic- Selenia and Dimensions 2D/DBT
 - Manufacturer calibrations
 - Required for Physicist during MEE, Annually and after relevant service
 - These can be used to calibrate out artifacts during testing.
 - Required Calibrations for Technologist
 - Weekly Gain Calibrations all Hologic Units
 - Semi-Annual Geometry Calibrations for Dimensions DBT

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Implementing Physics Testing

- Hologic- Selenia and Dimensions 2D/DBT (cont.)
 - SmartCurve Paddle must be tested using manufacturer’s method. Paddle edge to chest wall can’t be tested conventionally.
 - Z Res Test and AEC Test
 - Cannot use ROI feature on machine to measure on DBT slices
 - Can use the distance measurement tool
 - Either use a RWS or download and use a DICOM viewer

Note: If the acquisition workstation **does not have ROI** capability, the medical physicist should use one of the following alternatives to complete the test:

- Make the ROI measurement on the radiologist workstation.
- Using image analysis software, make the ROI measurement on an external computer system.
- If neither of the above alternatives are available, use the manufacturer’s AEC evaluation procedure, equipment, and form.

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2018 ACR DM QC Manual p.169

Implementing Physics Testing

- GE- 2000D, DS, Essential, SenoClaire, Pristina
 - SenoClaire and Pristina
 - Cannot view DBT images on the Acquisition Workstation (AWS)
 - Measurements for the DBT portion of the testing will have to be on a RWS, technologist review workstation, or external computer with features to measure distance and ROIs
 - Produces Planes and Slabs – Planes should be used for DBT Volume Coverage Test and Z-resolution test
 - SenoClaire has the “add-on” MTD bucky
 - All GE systems have QAP testing which may be useful for acceptance testing and troubleshooting.
 - Pro: Can omit the Subsystem MTF test

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Implementing Physics Testing

- Siemens-Novation, Inspiration 2D/DBT, Revelation
 - Gain Calibrations
 - Novation –Weekly
 - Inspiration 2D and 3D- Quarterly
 - Revelation 2D and 3D- Quarterly
 - No problem with ROI and distance measurements on DBT

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Implementing Physics Testing

- CR-Fuji, Konica, Carestream, AGFA
 - Most CR systems have manufacturer tests that are specific to the system which may be useful for acceptance testing and troubleshooting
 - S-Value (EI) Test
 - Erasure Tests
 - PSP Plate Replacement
 - ≤2 – Physicist Oversight
 - >2 – Requires Physicist MEE

Note: If the facility replaces all of its PSP plates with new ones, the medical physicist **must** perform an MEE consisting of applicable tests.

2018 ACR DM QC Manual p.181

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Implementing Physics Testing

- Review Workstations (RWS)
 - Onsite Radiologist
 - RWS must be tested to the ACR 2018 QC manual standards within 14 months of the previous survey.
 - Teleradiology
 - Reading solely for sites that have adopted the new QC manual
 - RWS survey meets the RWS requirements for the new manual
 - Reading for sites that have both
 - RWS survey meets the RWS manufacturer’s requirements and requirements for the new manual
 - If the RWS is off-site and is used to read for a site that has adopted the new manual, it must be tested to the new manual’s standards by the next annual due date or earlier. ★

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Implementing Physics Testing

- Review Workstations (RWS)
 - The new manual requires the pathway from the Mammography unit to the display device be evaluated. This is done by reviewing a FFDM phantom on each display device. This complex system is diagrammed in the manual in 5 figures.

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New Units and New Displays

Figure 2. MEE – All New Digital Mammography Units and Display Devices.

2018 ACR DM QC Manual p.132

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New Units and Existing Displays

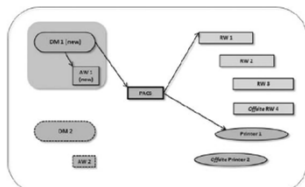


Figure 3. MEE – New Digital Mammography Units (with Existing Display Devices).

New Displays and Existing Mammography Units

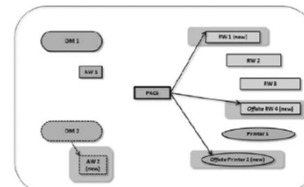
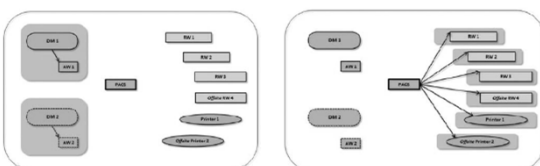


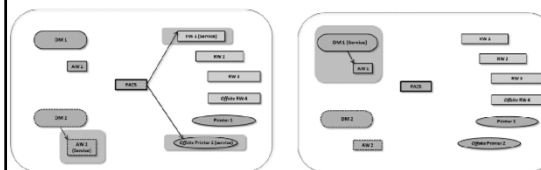
Figure 4. MEE – New Display Devices (with Existing Digital Mammography Units).

Annual Surveys



2018 ACR DM QC Manual p.134

Major Component Service/ Upgrade/ Repair/ Replacement



2018 ACR DM QC Manual p.136

Implementing Physics Testing

- You must be aware of the State Requirements where you implement this new manual
 - Several States have regulations that require some of the optional/troubleshooting tests
 - You may not be able to omit some tests

Outline

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MP Involvement Post Adjustments, Changes and Repairs

This manual provides information regarding equipment adjustments, changes or repairs. The manual is intended for use by medical physicists who are responsible for the quality control of the mammography system. It is not intended for use by technologists or other personnel who are not trained in the use of this manual.

Table 3. Medical Physicist Involvement in Equipment Adjustments, Changes or Repairs

Item	Comment	Major Repair	Medical Physicist Involvement
Automatic Exposure Control (AEC)	AEC adjustment	F	Onsite
Compton/ECG	AEC calibration that affects dose	F	Onsite
	AEC sensor replacement	F	Onsite
	AEC sensor based replacement	F	Onsite
	Compton sensor calibration adjustment	N	Onsite
	Thickness compensation "under" adjustment	N	Onsite
Quality Improvement	AEC sensor site repair	F	Onsite
	AEC sensor not replaced	N	Onsite
Collimator	Collimator adjustment	F	Onsite
	Reassembly and/or replacement	F	Onsite
Compression Device	Adjustment	N	Onsite
	Device replacement	N	Onsite
	Thickness scale accuracy adjustment but only if affects performance	N	Onsite
	Repair of sensor compression	N	Onsite
Compression Table	Table structure failure	N	Onsite
	Deflection adjustment	N	Onsite
	Table down due to repetition beyond allowable limit, or table not moving	N	Onsite
Image Unit	Insulation	F	Onsite
	Fluorescence	F	Onsite
	If any other replacement	F	Onsite
	High voltage generator replacement	F	Onsite
	Filter replacement	F	Onsite
	Manufacturing software upgrade or modification	F	Onsite
	Detector sensor replacement or repair	F	Onsite
Display Devices	High resolution image display	N	Onsite
	New monitor/replacement	F	Onsite
	New software or software upgrade	F	Onsite
Computed Radiography (CR) and Photographic (Phlogor) PSP Plates	Inspection	N	Onsite
	New CR calibration or replacement of CR reader	F	Onsite
	Replacement of CR plates	F	Onsite
	One of two CR plates	N	Onsite

Detailed adjustments with manufacturer approval of the quality control for made by the operator.

FDA Policy Guidance Help System 2018 ACR DM QC Manual p.138

MP Involvement Post Adjustments, Changes and Repairs

- AEC Calibration that Affects Dose
 - Previously this could be done by scaling the dose respectively to the mAs of a phantom taken by the technologist and could be done remotely, now it requires and onsite visit
 - Engineers tend to adjust this during the PMs, so training them to notify us is important
- Manufacturer’s Software Upgrade or Modifications
 - Previously there was an alternative standard that let the manufacturer determine if this modification was extensive enough to required an onsite survey. Now it requires an onsite survey. This manual does not specify if the alternative would still apply. Open to interpretation.
- Videocard or Software Upgrade for RWS
 - PACS administrators tend to make these adjustments with notifying anyone.

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Conclusion

- This manual is an option that may be a correct choice for a facility after careful consideration and planning.
- Most benefit for multi-manufacturer facilities.

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References

- Berns EA, et al., “ACR 2018 Digital Mammography Quality Control Manual: 2D and Digital Breast Tomosynthesis”, November 2018
- FDA Policy Guidance Help System
<https://www.fda.gov/Radiation-EmittingProducts/MammographyQualityStandardsActandProgram/Guidance/PolicyGuidanceHelpSystem/default.htm>
- Gress DA, “ACR Accreditation: Frequently Asked Questions for Medical Physicists”, AAPM Newsletter, Volume 44 No.2, March/April 2019
- ACR FAQs for New Digital Manual,
<https://www.acraccreditation.org/-/media/ACRAccreditation/Documents/Resources/DMQC/DMQCF AQs.pdf?la=en>

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