2018 ACR DM QC Manual

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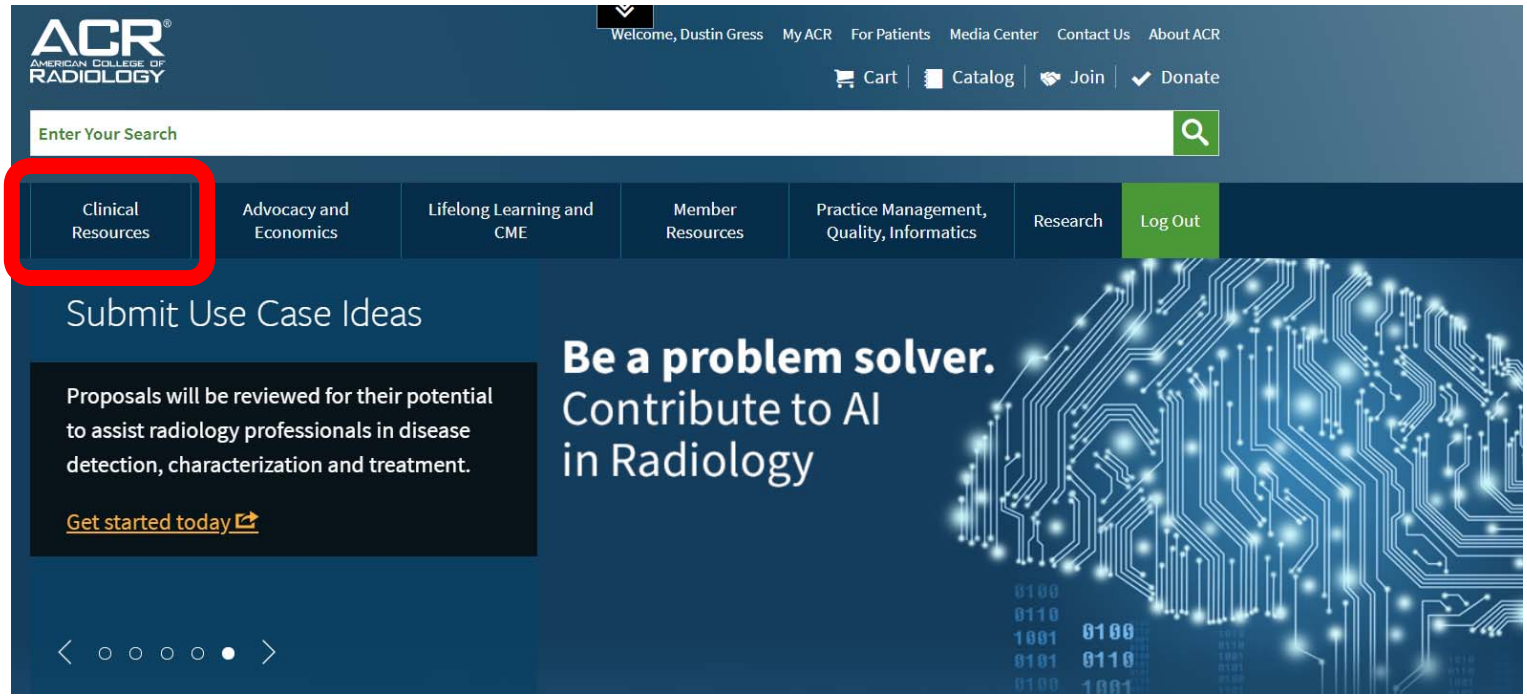
Outline

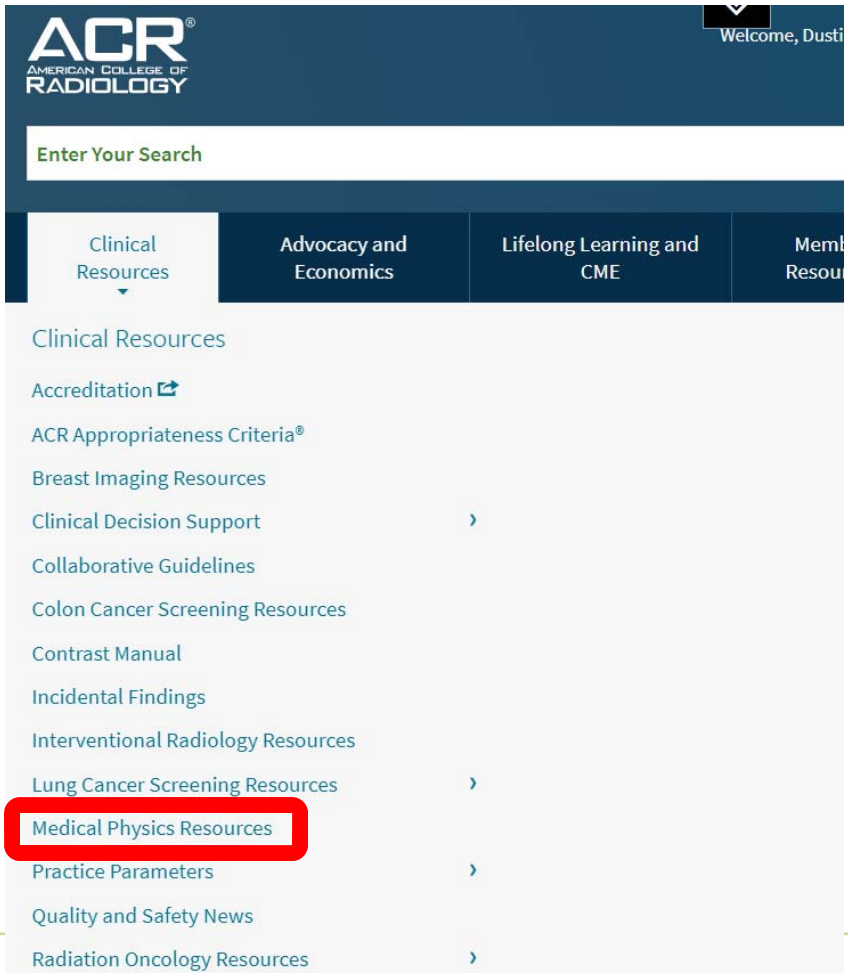
- Why switch?
- Overview of phantom & select tests
- Transitioning & some key details
- Resources

Alternative standards

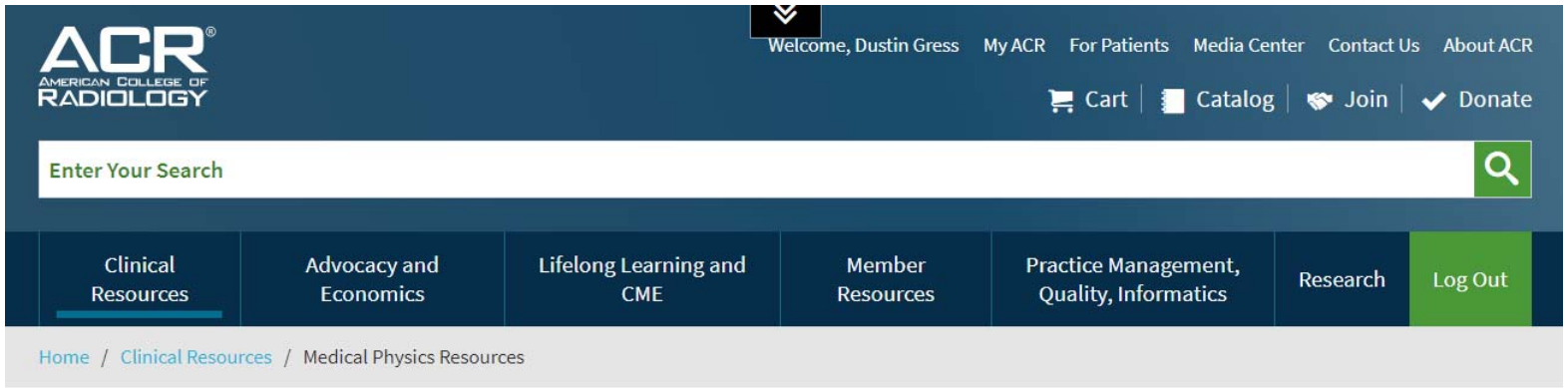
- 2016: FDA approved ACR DM QC Manual as alternative standard…
- 2018: FDA approved supplemental DBT material to be integrated into ACR DM QC Manual

For ACR Members in Physics





- https://www.acr.org/Clinical-Resources/Medical-Physics-Resources



Medical Physics Resources

These ACR resources, relevant to medical physicists, are both public and member-only and include ACR quality control manuals, ACR Accreditation resources, guidance documents, patient communication tools, and other helpful information.

Quality Control Manuals

CT »

Mammography »

MR »

Stereotactic Breast Biopsy

Standardization

- It’s good.

Standardization

- Expect cleaner MQSA inspections
- Standardization reduces errors
- No more chasing down mfr manual versions
- Current and future revisions will always be available
- Current and future forms will always be free

Standardizing:

- Tests themselves
- Test frequencies
- Performance criteria
- Clinical relevance
- Operator-friendliness

Paradigm emphasis

- 1. Radiologist leadership and oversight
- 2. MD-RT-MP teamwork
- 3. Medical physicist ownership

QA Committee (QAC)

- "Should"
- LIP, RT, MP, mgr, sup. RT, QC RT, other radiology (e.g. nurse, desk attendant, etc.)

- Ideally owns Facility QC Review…

9. Facility QC Review

Quarterly

Image Mode *(2D, 2D w/Add-on DBT, DBT)* _____

Facility _____ **Date of QC Mtg** _____

1. Review Medical Physics Surveys and Results — **Reviewed** ☐

	Room 1	Room 2	Room 3	Room 4	Room 5
Room ID					
Date of last Medical Physicist (MP) survey					
MP DM QC Test Summary reviewed by radiologist?					
All MP corrective actions completed?					
ACR DM Phantom Average Glandular Dose (mGy)					
Fiber Score					
Speck Score					
Mass Score					

2. Review Tech QC ☐

Test	*Frequency*	*Summary Comments from Last Quarter*	
1. ACR DM Phantom Image Quality	Weekly		☐
2. CR Cassette Erasure *(if app)*	Weekly		☐
3. Compression Thickness Indicator	Monthly		☐
4. Visual Checklist	Monthly		☐
5. AW Monitor QC	Monthly		☐
6. RW Monitor QC	Monthly		☐
7. Film Printer QC	Monthly		☐
8. Viewbox Cleanliness *(if app)*	Monthly		☐
9. Facility QC Review	Quarterly		☐
10. Compression Force	Semiannual		☐
11. Manufacturer Calibrations *(if app)*			☐
Optional - Repeat Analysis	As Needed	% Repeats ☐	☐

Scores of most recent phantom image:	Room 1	Room 2	Room 3	Room 4	Room 5
Date					
Fiber score					
Speck group score					
Mass score					

3. Review and verify completion of all "Corrective Action" ☐

4. Technique Chart review for each room (see MP report for recommendations) - (Annually) ☐

5. Infection Control procedures followed ☐

6. Offsite RW(s) & Film Printer(s) QC reviewed _____ ☐

7. Past and future service or service upgrades discussed *(if app)* ☐

8. Past and future State and/or MQSA inspections discussed *(if app)* ☐

9. Past and future ACR Accreditation issues discussed *(if app)* ☐

9. Facility QC Review *(cont)*

Quarterly

Facility _____ **Date of QC Mtg** _____

10. Notable findings during QC meeting — **Follow-up Confirmed** *(If App.)*

11. Items for quality improvement from QC Meeting

12. Other QC Notes

Overall Pass/Fail _____

Lead Interpreting Radiologist *signature*	Facility Manager (If App) *signature*	QC Technologist *signature*

Action Limit:	**Required:**	Lead interpreting radiologist and facility manager must review QC quarterly. The test passes if meeting held.
	Recommended:	Technologist and lead interpreting radiologist should review technique charts at least annually for each DM system.
	Timeframe:	Not applicable.

iology

Radiologist feedback

Optional - Radiologist Image Quality Feedback *As Needed*

(For Quality Improvement)

Radiologist's Name _____

Date _____

Procedure	This report is to be completed by the Interpreting Radiologist when asked to interpret sub-optimal cases requiring the patient to be called back. The form may also be used to provide feedback on excellent quality. The radiologists should complete this form as needed for each case. A system should be in place for analyzing feedback and taking measures for improvement as necessary.

Objective For the Radiologist to provide routine feedback to the technologists and manager on the quality of images.

Patient Identifier: _____

Technologist's Name: _____

Date of Exam: _____

Overall Assessment

☐ Excellent ☐ Good ☐ Needs improvement, but do not repeat ☐ Sub-Optimal, and should be repeated

Image Evaluation

	RCC	LCC	RMLO	LMLO	Other View	Other View
Positioning						
Missing tissue						
Laterally						
Posteriorly						
Medially						
Inferiorly						
Nipple not in profile						
Skin fold						
Pectoralis not down to PNL						
Tissue droopy (camel nose)						
Narrow/concave pectoralis						
Inframammary fold						
Not open						
Not shown						
Centering not correct						
Technical Issues						
Not enough compression						
Exposure Too Low (Excessive Noise)						
Exposure Too High (Image Saturation)						
Patient Motion						
Artifacts						
Incorrect Patient ID						
Other						

Additional Images Needed for Complete Breast Evaluation

Requested views ☐ RCC ☐ LCC ☐ RMLO ☐ LMLO ☐ Other View _____

Action Limits	**Recommended:**	Patients should be called back for additional images if the quality is suboptimal according to the interpreting radiologist's request.
	Timeframe:	Not applicable.

	RCC	LCC	RMLO
Positioning			
Missing tissue			
Laterally			
Posteriorly			
Medially			
Inferiorly			
Nipple not in profile			
Skin fold			
Pectoralis not down to PNL			
Tissue droopy (camel nose)			
Narrow/concave pectoralis			
Inframammary fold			
Not open			
Not shown			
Centering not correct			
Technical Issues			
Not enough compression			
Exposure Too Low (Excessive Noise)			
Exposure Too High (Image Saturation)			
Patient Motion			
Artifacts			
Incorrect Patient ID			
Other			

Medical Physicist QC Letter for the Radiologist

January 25, 2019

Lead Rad, MD
Breast Center USA
1234 Smith Road

Los Angeles, CA. 10001

Re: Medical Physicist Survey of Room 1 Manf AA Unit BB on January 25, 2019

Dear Lead Interpreting Radiologist,

The above mammography unit at your facility recently underwent an Annual Medical Physics Survey. Below is the relevant summary information as a result of this survey. Please note that your facility must follow-up on the Action Items below and obtain relevant documentation from the service engineer. Please evaluate the ACR Digital Mammography Phantom image acquired during the medical physicist testing (Image ID information listed below) and see my comments. If you have any questions please don't hesitate to call.

• Image Quality

Patient Name (Phantom): Phantom 1
Patient ID (Phantom): 123
Date: 1/25/19

ACR Digital Mammography Phantom Scores

	Room 1			
	2D	DBT	Passing Criteria	Pass /Fail
Fiber score	5.0	5.0	≥ 2.0	Pass
Speck group score	4.0	4.0	≥ 3.0	Pass
Mass score	4.0	4.0	≥ 2.0	Pass
Artifacts	None	None	No Clinically Significant Artifacts	Pass

Comments on phantom image:

• Radiation Dose

ACR Digital Mammography Phantom Radiation Dose Values

	Room 1			
	2D	DBT	Passing Criteria	Pass /Fail
ACR Phantom Dose (mGy)	1.35	1.49	≤ 3.0	

Note: The above dose is an estimate determined with a phantom representing the FDA-defined 4.2 cm thick, 50% glandular/50% adipose standard breast. Doses will vary with patient size and density. Specific patient doses can be estimated by your medical physicist.

Comments on radiation dose:

Medical Physicist QC Summary Letter for the Radiologist (cont)

• Required Action Items

Time Frame	Description

• Recommended Action Items

Time Frame	Description

• Comments on Monitors, Monitor QC, & Viewing Conditions

Time Frame	Description

• Comments on Tech QC

Time Frame	Description

If you have any questions, please do not hesitate to call.

Sincerely,

MP Name

Phone 111-222-3333
Email mp.email@email.com

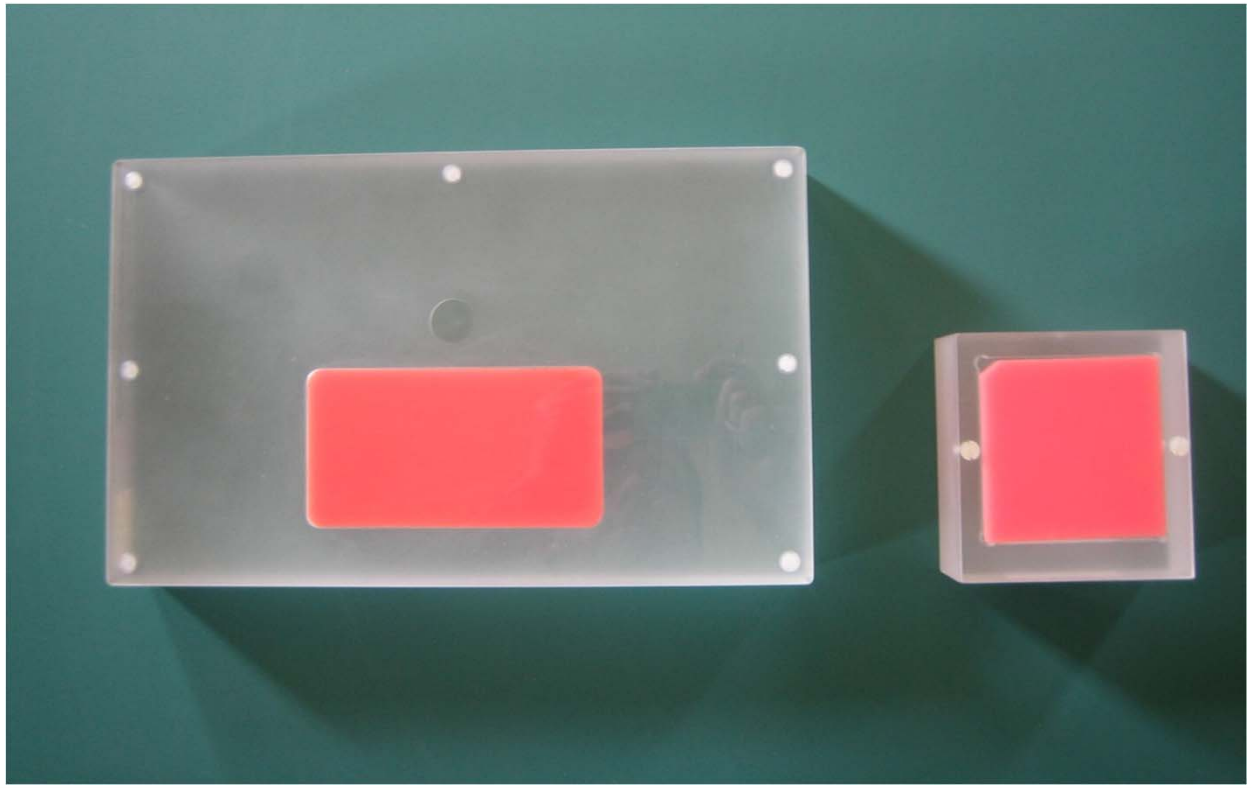
Demonstrate value

- Re-establish relationships
- Be the go-to resource
- Direct lines of communication

Improved efficiency

- Fewer QC tests than mfr
- Less total time spent on QC tests
- Excel and pdf forms available for free
- 2D and DBT both included, streamlined

Phantom



Purchasing phantom

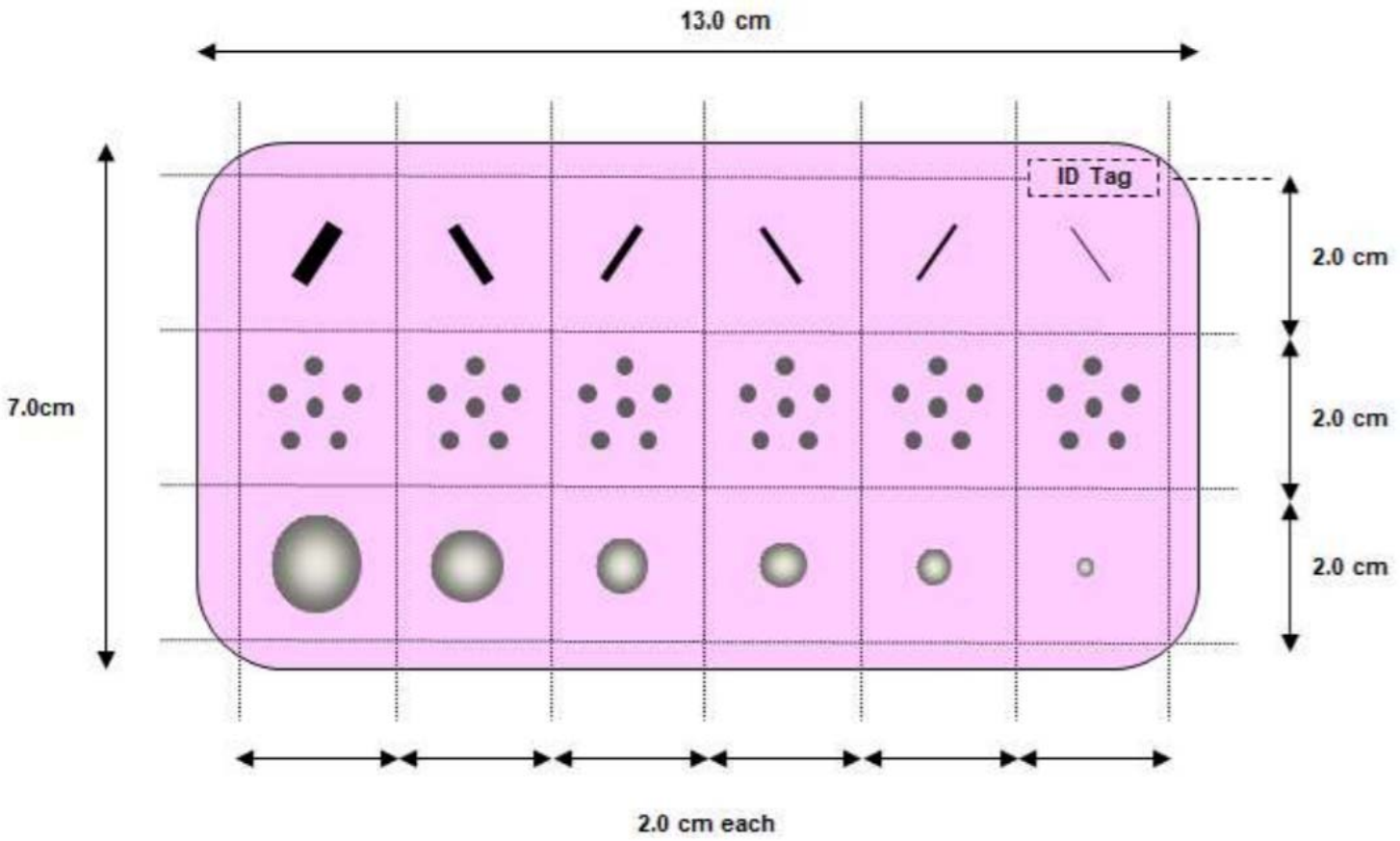
- Must be from approved manufacturer
- Google “acr digital mammography qc manual resources”
- https://www.acraccreditation.org/resources/digital-mammography-qc-manual-resources
- Mfr list at bottom of page

ACR Digital Mammography Phantom Scoring Key*

Test Object	Full Point	Half Point
Fibers (6)	• Full length visible (≥8 mm long) • Correct location • Correct orientation • 1 break allowed (must be ≤ width of fiber)	• At least half of length visible (≥5 and <8 mm long) • Correct location • Correct orientation • 1 break allowed (must be ≤ width of fiber)
Speck Groups (6)	• 4 - 6 specks visible • Correct locations	• 2 - 3 specks visible • Correct locations
Masses (6)	• Density difference visible • Border is continuous and generally circular (≥ ¾ border visible) • Correct location	• Density difference visible • Border is not continuous or generally circular (≥ ½ and < ¾ border visible) • Correct location
Artifacts	Only fail for artifacts if they are in a location that could impact clinical interpretation ***and*** they are clinically significant. Fail if: • Artifacts are as prominent as (or more prominent than) the visible test objects in the phantom image, or • Artifacts obscure test objects in the phantom, or • Artifacts could affect clinical interpretation	

Performance Criteria: ≥2 fibers, ≥3 speck groups, ≥2 masses, no clinically-significant artifacts

** Consult the ACR 2018 Digital Mammography Quality Control Manual and the FAQs for complete information on scoring the phantom.*


13.0 cm
ID Tag
7.0cm
2.0 cm
2.0 cm
2.0 cm
2.0 cm each


Serial Number

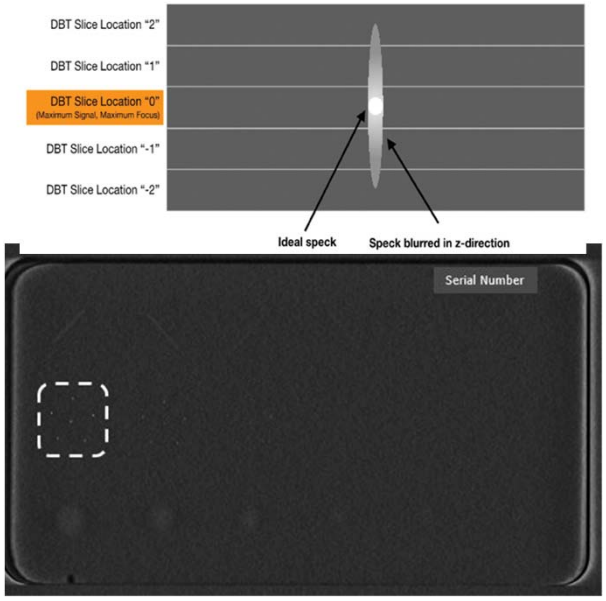
Pass Criteria: **2 Fibers, 3 Specks, 2 Masses**

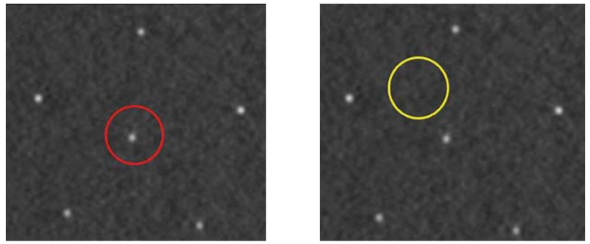
Equivalent to SFM Phantom: **4 Fibers, 3 Specks, 3 Masses**

Unit MP tests (annual)

- Phantom – IQ & artifacts
- DBT Z-resolution
- Spatial resolution
- DBT volume coverage
- AEC
- Collimation (DBT only)
- AGD (HVL & output)

3. DBT Z Resolution



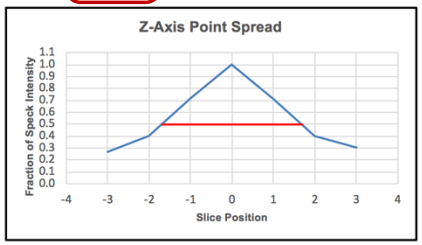


*This test may require evaluation downstream from AW if AW can't provide ROI capabilities

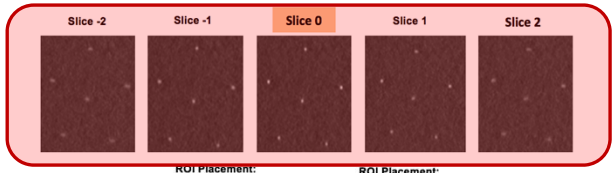
Facility Name	Breast Center USA	**MAP ID-Unit#** *(00000-00)*	54321 - 01
Mfr & Model	Manf AA Unit BB	**Room ID**	Room 1
		Survey Date	January 25, 2019

Procedure	**Equipment:** DBT image from ACR DM Phantom Image Quality test	**MEE Date:**	1/20/18
		MEE Baseline FWHM:	3.28

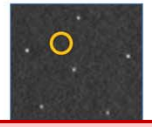
Slice #	Relative Slice Location	Maximum Speck Signal: Center Speck	12:00 Speck	2:00 Speck	5:00 Speck	7:00 Speck	10:00 Speck	Ave Max Signal	Mean Background Signal
	-3	459	442	444	428	433	445	442	373
	-2	470	478	463	473	456	502	474	373
	-1	542	574	539	562	530	583	555	374
	0	549	683	638	651	596	637	626	374
	1	494	596	589	544	532	552	551	373
	2	459	493	491	459	468	475	474	372
	3	445	453	468	440	444	449	450	373



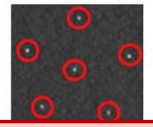
Z-Res Diff (Ave Max - Background Mean)	△ Z-Res Diff relative to DBT Slice 0
68.55	0.27
100.38	0.40
181.43	0.72
252.07	1.00
178.47	0.71
101.92	0.40
76.73	0.30
Current FWHM	**3.37 mm**
MEE Baseline FWHM	**3.28 mm**
% Change (Current vs MEE)	**2.7%**
Overall Pass/Fail	**Pass**



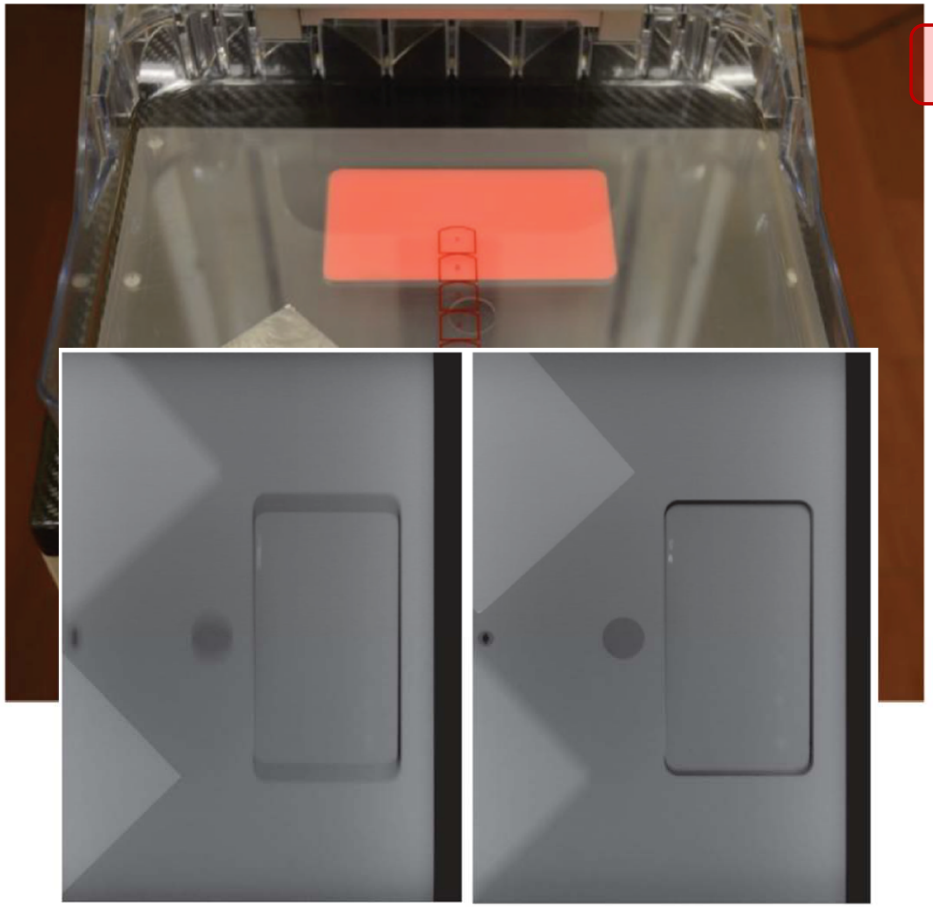
ROI Placement: **Mean Background Signal - Next to Center Speck**



ROI Placement: **Maximum Signal - Over Each Speck**



Action Limits	**Required:**	Annual Survey: FWHM must be within ±30% of the baseline (MEE) value. MEE: No action limit.
	Timeframe:	Failures must be corrected within 30 days.



5. DBT Volume Coverage

Facility Name Breast Center USA
Mfr & Model Manf AA Unit BB

MAP ID-Unit# *(00000-00)* 54321 - 01
Room ID Room 1
Survey Date January 25, 2019

Procedure	**Equipment:** ACR DM Phantom, 2 sheets of 0.1 mm Al	**Phantom Setup:**
	Place ACR DM Phantom on breast support in the usual position	Paddle size (IR size):
	Place Al sheets on top and bottom of DM phantom, diagonally across chest wall	Paddle type (reg or flex):
	Acquire DBT image of phantom	
	View reconstructed image and verify that both Al sheets are in focus within the volume	

		Contact Mode
Setup Techniques	Mag factor	Contact
	Target/filter	W/Ag
	kVp	28
	mAs	102
Results (Yes/No/NA)	Lower Al sheet in focus within the volume	Yes
	Upper Al sheet in focus within the volume	Yes
	Overall Pass/Fail	**Pass**

Action Limits	**Required:**	Both sheets must be focused in volume
	Timeframe:	Failures must be corrected before clinical use.

MEE only

- HVL
- kVp
- 2D collimation

Item	Component	Major Repair	Medical Physicist Involvement
Automatic Exposure Control (AEC)	***AEC replacement***	***Y***	***On-site***
	AEC recalibration that effects dose	***Y***	***On-site***
	AEC sensor replacement	***Y***	***On-site***
	AEC circuit board replacement	***Y***	***On-site***
	Density control - internal adjustment*	N	Oversight
	Thickness compensation internal* adjustment	N	Oversight
Bucky Replacement	***AEC sensor also replace***	***Y***	***On-site***
	AEC sensor not replaced	N	Oversight
	DM detector also replaced	***Y***	***On-site***
	DM detector not replaced	N	Oversight
Collimator	***Replacement***	***Y***	***On-site***
	Reassembly with blade replacement	***Y***	***On-site***
	Adjustment	N	Oversight
Compression Device	Pressure adjustment	N	Optional
	Thickness scale accuracy adjustment but only if it affects AEC performance	N	Oversight
	Repair of auto decompression	N	Optional
Compression Paddle	Paddle (new to facility)	N	Oversight
	Deflection adjustment	N	Oversight
	Adjustment due to extension beyond allowable limit, or visible on images	N	Oversight
X-ray Unit	***Installation***	***Y***	***On-site***
	Reassembly	***Y***	***On-site***
	X-ray tube replacement	***Y***	***On-site***
	High voltage generator replacement	***Y***	***On-site***
	Filter replacement	***Y***	***On-site***
	Manufacturer's software upgrade or modifications	***Y***	***On-site***
	DM detector replacement or repair	***Y***	***On-site***
	kVp, mA or time internal* adjustments	N	Oversight
Display Devices	***New installation or replacement***	***Y***	***On-site***
	New video card or software upgrade	***Y***	***On-site***
	Relocation	N	Oversight
Computed Radiography (CR) and Photostimulable Phosphor (PSP) Plates	***New installation or replacement of CR reader***	***Y***	***On-site***
	Replacement of all PSP plates	***Y***	***On-site***
	One or 2 new PSP plates	N	Oversight

**Internal adjustments refer to equipment adjustments that typically cannot be made by the operator.*

- Major Component Service, Upgrade, Replacement & Repair

*This test may require evaluation downstream from AW if AW can't provide ROI capabilities

6. Automatic Exposure Control System Performance

Image Mode *(2D, 2D w/Add-on DBT, DBT)*: 2D

Facility Name: Breast Center USA
Mfr & Model: Manf AA Unit BB
MAP ID-Unit# *(00000-00)*: 54321 - 01
Room ID: Room 1
Survey Date: January 25, 2019

Procedure

Equipment: 2, 4, 6, 8 cm of BR-12, BR-50 or acrylic
Install small paddle (reg or flex) (Use large if small not available)
Use regular or flex paddle used for most clinical imaging
Set thickness at actual thickness of phantom (2, 4, or 6 cm)
Acquire images using clinical techniques
SNR data must be obtained from raw image
Magnification stand, if used clinically for 2D

Phantom Setup:
Paddle size (IR Size):
Paddle type (reg or flex):
AEC cell position (if avail):
Mag setting: 1.8
Mfr DC offset, if app: 50.000
Other settings:

AEC Thickness Tracking

		Setup Techniques		Resultant Techniques				Signal and Noise Measurements			
Mode	Thick-ness (cm)	AEC Mode	Density setting	Target/ Filter	kVp	mAs	Other	Mean Bkgd Signal	Std Dev of Bkgd	DC Offset (if app)	SNR
Contact	2	Auto-Filter	**	W/Rh	25	49		320.00	4.50	50.00	60.00
Contact	4	Auto-Filter	**	W/Rh	28	85		332.00	4.90	50.00	57.55
Contact	6	Auto-Filter	**	W/Rh	31	192		365.00	5.10	50.00	61.76
Contact	8	Auto-Filter	**	W/Ag	32	237		550.00	5.30	50.00	94.34
Mag*	4	Auto-Filter	**	W/Rh	29	94		450.00	4.20	50.00	95.24

*2D only

Analysis

$$SNR = \frac{(Mean\ Bkgd\ Signal - DC\ offset)}{Std\ Dev\ of\ Bkgd}$$

			MEE and Annual		Annual			
Mode	Thick-ness (cm)	SNR	Lowest Limit for SNR	Pass/Fail	MEE SNR	Lower Limit	Upper Limit	SNR within ±15% of MEE (P/F)
Contact	2	60.0			58.0	49.3	66.7	P
Contact	4	57.6	40.0	P	61.0	51.9	70.2	P
Contact	6	61.8			63.0	53.6	72.5	P
Contact	8	94.3			96.0	81.6	110.4	P
Mag*	4	95.2			92.0	78.2	105.8	P
						Overall Pass/Fail		Pass

*2D only

Action Limits

Required: MEE and Annual: SNR must be ≥ 40.0 for 4.0 cm in contact mode.
Annual: SNR must be within ±15% of MEE over the clinically used phantom thickness and imaging modes.

Timeframe: Failures must be corrected within 30 days; for MEEs, before clinical use.

Typo

- AEC Performance Criteria

MEE and Annual Surveys

2D

The SNR ***must*** be ≥40.0 for the 4.0 cm phantom in ~~the DBT~~ mode.

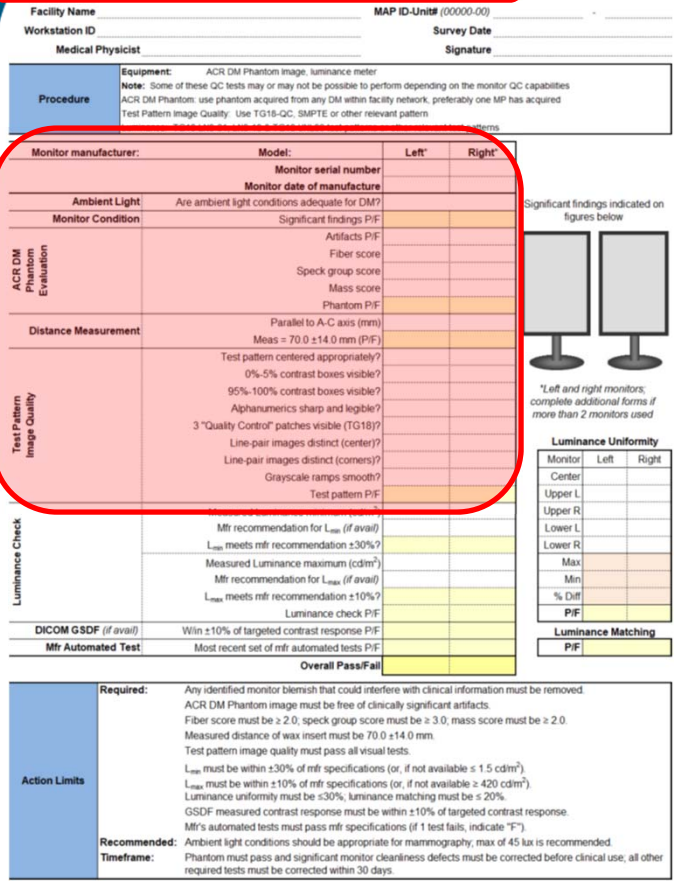
Annual Surveys

The SNR must be within ±15% of the last MEE's SNR for each thickness and mode tested. (This component of the test does not apply to MEEs.)

Why else?

- QC program structured for modern facilities
  - Multiple units… multiple RWS… multiple facilities
- New, better phantom
- More efficient artifact detection
- Team approach w/QA Committee
- Radiologist feedback incorporated

11. Radiologist Workstation (RW) Monitor QC



Facility Name _____ MAP ID-Unit# *(00000-00)* _____ - _____

Workstation ID _____ Survey Date _____

Medical Physicist _____ Signature _____

Procedure

Equipment: ACR DM Phantom image, luminance meter

Note: Some of these QC tests may or may not be possible to perform depending on the monitor QC capabilities

ACR DM Phantom: use phantom acquired from any DM within facility network, preferably one MP has acquired

Test Pattern Image Quality: Use TG18-QC, SMPTE or other relevant pattern

		Monitor manufacturer:	Model:	Left*	Right*
			Monitor serial number		
			Monitor date of manufacture		
	Ambient Light	Are ambient light conditions adequate for DM?			
	Monitor Condition	Significant findings P/F			
ACR DM Phantom Evaluation		Artifacts P/F			
		Fiber score			
		Speck group score			
		Mass score			
		Phantom P/F			
	Distance Measurement	Parallel to A-C axis (mm)			
		Meas = 70.0 ±14.0 mm (P/F)			
Test Pattern Image Quality		Test pattern centered appropriately?			
		0%-5% contrast boxes visible?			
		95%-100% contrast boxes visible?			
		Alphanumerics sharp and legible?			
		3 "Quality Control" patches visible (TG18)?			
		Line-pair images distinct (center)?			
		Line-pair images distinct (corners)?			
		Grayscale ramps smooth?			
		Test pattern P/F			
Luminance Check		[illegible]			
		Mfr recommendation for L_{min} *(if avail)*			
		L_{min} meets mfr recommendation ±30%?			
		Measured Luminance maximum (cd/m^2)			
		Mfr recommendation for L_{max} *(if avail)*			
		L_{max} meets mfr recommendation ±10%?			
		Luminance check P/F			
	DICOM GSDF *(if avail)*	Wlin ±10% of targeted contrast response P/F			
	Mfr Automated Test	Most recent set of mfr automated tests P/F			
		Overall Pass/Fail			

Significant findings indicated on figures below

**Left and right monitors; complete additional forms if more than 2 monitors used*

Luminance Uniformity

Monitor	Left	Right
Center		
Upper L		
Upper R		
Lower L		
Lower R		
Max		
Min		
% Diff		
P/F		

Luminance Matching

P/F	

Action Limits

Required: Any identified monitor blemish that could interfere with clinical information must be removed.
ACR DM Phantom image must be free of clinically significant artifacts.
Fiber score must be ≥ 2.0; speck group score must be ≥ 3.0; mass score must be ≥ 2.0.
Measured distance of wax insert must be 70.0 ±14.0 mm.
Test pattern image quality must pass all visual tests.
L_{min} must be within ±30% of mfr specifications (or, if not available ≤ 1.5 cd/m^2).
L_{max} must be within ±10% of mfr specifications (or, if not available ≥ 420 cd/m^2).
Luminance uniformity must be ≤30%; luminance matching must be ≤ 20%.
GSDF measured contrast response must be within ±10% of targeted contrast response.
Mfr's automated tests must pass mfr specifications (if 1 test fails, indicate "F").

Recommended: Ambient light conditions should be appropriate for mammography; max of 45 lux is recommended.

Timeframe: Phantom must pass and significant monitor cleanliness defects must be corrected before clinical use; all other required tests must be corrected within 30 days.

RWS

Monitor manufacturer:	Model:	Left*	Right*
	Monitor serial number		
	Monitor date of manufacture		
Ambient Light	Are ambient light conditions adequate for DM?		
Monitor Condition	Significant findings P/F		
ACR DM Phantom Evaluation	Artifacts P/F		
	Fiber score		
	Speck group score		
	Mass score		
	Phantom P/F		
Distance Measurement	Parallel to A-C axis (mm)		
	Meas = 70.0 ±14.0 mm (P/F)		
Test Pattern Image Quality	Test pattern centered appropriately?		
	0%-5% contrast boxes visible?		
	95%-100% contrast boxes visible?		
	Alphanumerics sharp and legible?		
	3 "Quality Control" patches visible (TG18)?		
	Line-pair images distinct (center)?		
	Line-pair images distinct (corners)?		
	Grayscale ramps smooth?		
	Test pattern P/F		

11. Radiologist Workstation (RW) Monitor QC

Facility Name _____ MAP ID-Unit# *(00000-00)* _____ - _____

Workstation ID _____ Survey Date _____

Medical Physicist _____ Signature _____

Procedure

Equipment: ACR DM Phantom image; luminance meter

Note: Some of these QC tests may or may not be possible to perform depending on the monitor QC capabilities

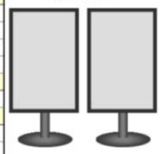
ACR DM Phantom: use phantom acquired from any DM within facility network, preferably one MP has acquired

Test Pattern Image Quality: Use TG18-QC, SMPTE or other relevant pattern

Luminance: TG18 LN8-01, LN8-18 & TG18 UNL80 test patterns or other relevant test patterns

		Model:	Left*	Right*
Monitor manufacturer:				
		Monitor serial number		
		Monitor date of manufacture		
Ambient Light	Are ambient light conditions adequate for DM?			
Monitor Condition	Significant findings P/F			
ACR DM Phantom Evaluation	Artifacts P/F			
	Fiber score			
	Speck group score			
	Mass score			
	Phantom P/F			
Distance Measurement	Parallel to A-C axis (mm)			
	Meas = 70.0 ±14.0 mm (P/F)			
Test Pattern Image Quality	Test pattern centered appropriately?			
	0%-5% contrast boxes visible?			
	95%-100% contrast boxes visible?			
	Alphanumerics sharp and legible?			
	3 "Quality Control" patches visible (TG18)?			
	Line-pair images distinct (center)?			
	Line-pair images distinct (corners)?			
	Grayscale ramps smooth?			
	Test pattern P/F			
Luminance Check	Measured Luminance minimum (cd/m^2)			
	Mfr recommendation for L_{min} *(if avail)*			
	L_{min} meets mfr recommendation ±30%?			
	Measured Luminance maximum (cd/m^2)			
	Mfr recommendation for L_{max} *(if avail)*			
	L_{max} meets mfr recommendation ±10%?			
	Luminance check P/F			
DICOM GSDF *(if avail)*	W/in ±10% of targeted contrast response P/F			
Mfr Automated Test	Most recent set of mfr automated tests P/F			
	Overall Pass/Fail			

Significant findings indicated on figures below



**Left and right monitors; complete additional forms if more than 2 monitors used*

Luminance Uniformity

Monitor	Left	Right
Center		
Upper L		
Upper R		
Lower L		
Lower R		
Max		
Min		
% Diff		
P/F		

Luminance Matching

P/F	

Action Limits

Required: Any identified monitor blemish that could interfere with clinical information must be removed.
ACR DM Phantom image must be free of clinically significant artifacts.
Fiber score must be ≥ 2.0; speck group score must be ≥ 3.0; mass score must be ≥ 2.0.
Measured distance of wax insert must be 70.0 ±14.0 mm.
Test pattern image quality must pass all visual tests.
L_{min} must be within ±30% of mfr specifications (or, if not available ≤ 1.5 cd/m^2).
L_{max} must be within ±10% of mfr specifications (or, if not available ≥ 420 cd/m^2).
Luminance uniformity must be ≤30%; luminance matching must be ≤ 20%.
GSDF measured contrast response must be within ±10% of targeted contrast response.
Mfr's automated tests must pass mfr specifications (if 1 test fails, indicate "F").

Recommended: Ambient light conditions should be appropriate for mammography; max of 45 lux is recommended.

Timeframe: Phantom must pass and significant monitor cleanliness defects must be corrected before clinical use; all other required tests must be corrected within 30 days.

RWS

Luminance Check	Measured Luminance minimum (cd/m^2)		
	Mfr recommendation for L_{min} *(if avail)*		
	L_{min} meets mfr recommendation ±30%?		
	Measured Luminance maximum (cd/m^2)		
	Mfr recommendation for L_{max} *(if avail)*		
	L_{max} meets mfr recommendation ±10%?		
	Luminance check P/F		
DICOM GSDF *(if avail)*	W/in ±10% of targeted contrast response P/F		
Mfr Automated Test	Most recent set of mfr automated tests P/F		
	Overall Pass/Fail		

Luminance Uniformity

Monitor	Left	Right
Center		
Upper L		
Upper R		
Lower L		
Lower R		
Max		
Min		
% Diff		
P/F		

Luminance Matching

P/F	

Tech RWS QC

6. Radiologist Workstation (RW) Monitor QC

Monthly

RW Location and ID _____

MAP ID# *(00000)* _____ **Monitor Mfr** _____ **Model** _____ **SN: Right** _____ **Left** _____

		Year																							
		Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		Date																							
		Tech Initials																							
		Monitor	R*	L*	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
Monitor Condition P/F *(significant findings)*																									
ACR DM Phantom	Artifacts P/F																								
	Fiber score																								
	Speck group score																								
	Mass score																								
	Phantom P/F																								
Test Pattern Image Quality	0%-5% contrast boxes visible																								
	95%-100% contrast																								
	Line-pair images distinct (center)																								
	Line-pair images distinct (corners)																								
	Test pattern P/F																								
Monthly Check - Mfr Automated Test P/F *(if avail)*																									
Overall Pass/Fail																									

P = Pass **F = Fail**

Action Limits		
	Required:	Any identified monitor blemish that could interfere with clinical information must be removed. ACR DM Phantom image must be free of clinically significant artifacts. Fiber score must be ≥ 2.0; speck group score must be ≥ 3.0; mass score must be ≥ 2.0. Test pattern image quality must pass all visual tests. Manufacturer's automated tests, if available, must pass mfr specifications (if 1 test fails, indicate F).
	Timeframe:	Phantom must pass and significant monitor cleanliness defects must be corrected before clinical use; all other tests must be corrected within 30 days.

** R and L - right and left monitors; if only 1 monitor, use "R" column*

14. Evaluation of Display Device Technologist QC Program

Facility Name _____ **MAP ID-Unit#** *(00000-00)* _____ - _____

Medical Physicist _____ **Display Device Location** _____

Signature _____ **Survey Date** _____

Display Device ID & Room	Display Device Description (RW, Printer, Viewbox)	Test Performed, Analyzed & Documented Incorrectly	Missing Data	Incorrect Scoring or Calculations	Missing Corrective Action Documentation	Mfr Automated Tests (if Applicable)	Other	Comments	P/F
Example: Mammography reading room	RW	✓	✓	✓	✓			Discussed with manager	P
Corrective Action Log documentation adequate?									
								Overall Pass/Fail for Performance of Display Device Technologist QC Program	

Additional Comments: _____

Applicability

- Adoption is a choice
- Each unit is a choice
- Manufacturers now also have a choice

Applicability

- CEM
- Units with CEM can use the ACR manual for 2D and DBT applications, but must use manufacturer QC for CEM applications

Transitioning

- Full MEE **not required**
- **Annual survey** required
  - "transition survey"
- MEE QC test data (HVL, kVp, 2D collimation) **must be available** for baseline and troubleshooting purposes
- Display devices

Ideas for transitioning

- Read the manual
- Read the manual again
- Have a meeting with lead tech, mgr, & LIP to plan
- Schedule time to train technologist(s)
- Be the expert – consider this an opportunity

Do I need to call my inspector?

- No.
- But documentation of transition dates for all devices is essential

Do I need to call ACR?

- No.
- Unless of course you have questions ☺

- ACR is accepting (re)submissions using new DM QC Manual

What's happening now?

- Outreach (hi!)
- CRCPD
- FDA → inspectors
- MITA / mfr

Resources

- ACR Digital Mammography QC Manual Resources
- Accreditation web page
- 1-800-227-6440
- mamm-accred@acr.org

DM QC Manual Resources

- Up-to-date FAQs
- Phantom scoring key (good for teaching!)
- Excel forms for QC tests (tech and med phys!)
- Webinars by Eric (tech and med phys!)
- Approved phantom vendors

Acknowledgements

- Eric Berns, PhD
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