

# General Purpose Ultrasound Phantom

Model 054GS



ZERDINE® Inside  
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## USER GUIDE

## **CONTENTS**

Overview .....	1
Specifications – Model 054GS.....	2
Zerdine® .....	4
Use of the Removable Water Well and Covers .....	5
Establishing a Baseline With Your New Phantom .....	6
Routine Quality Control Measurements.....	7
Uniformity .....	8
Near Field Group .....	8
Vertical Distance Group .....	9
Horizontal Distance Group .....	12
Axial / Lateral Resolution Groups .....	13
Anechoic Cylinders .....	15
Gray Scale Targets .....	16
Analysis .....	17
Care and Handling.....	18
Warranty.....	19

## **OVERVIEW**

The guidelines for the phantom design are:

- To provide a sturdy reliable phantom containing the fundamental tests to assess imaging performance of an ultrasonic system over time.

The improved features of this phantom include:

- New combined axial and lateral resolution targets with separation from 4 mm down to 0.25 mm using wires of 80 microns diameter instead of 100 microns. The 36% reduction in the cross sectional area of the target wires provides a much improved sensitivity for the resolution test.
- Anechoic cylinders at depths from 4 cm to 16 cm with 8 mm diameter.
- All targets have an attenuation of 0.5 dB to minimize the effects of shadowing and enhancement behind targets.

The new features of this phantom include:

- Gray scale targets at 4 cm depth to assess contrast sensitivity between anechoic to greater than +15 dB with respect to the background.

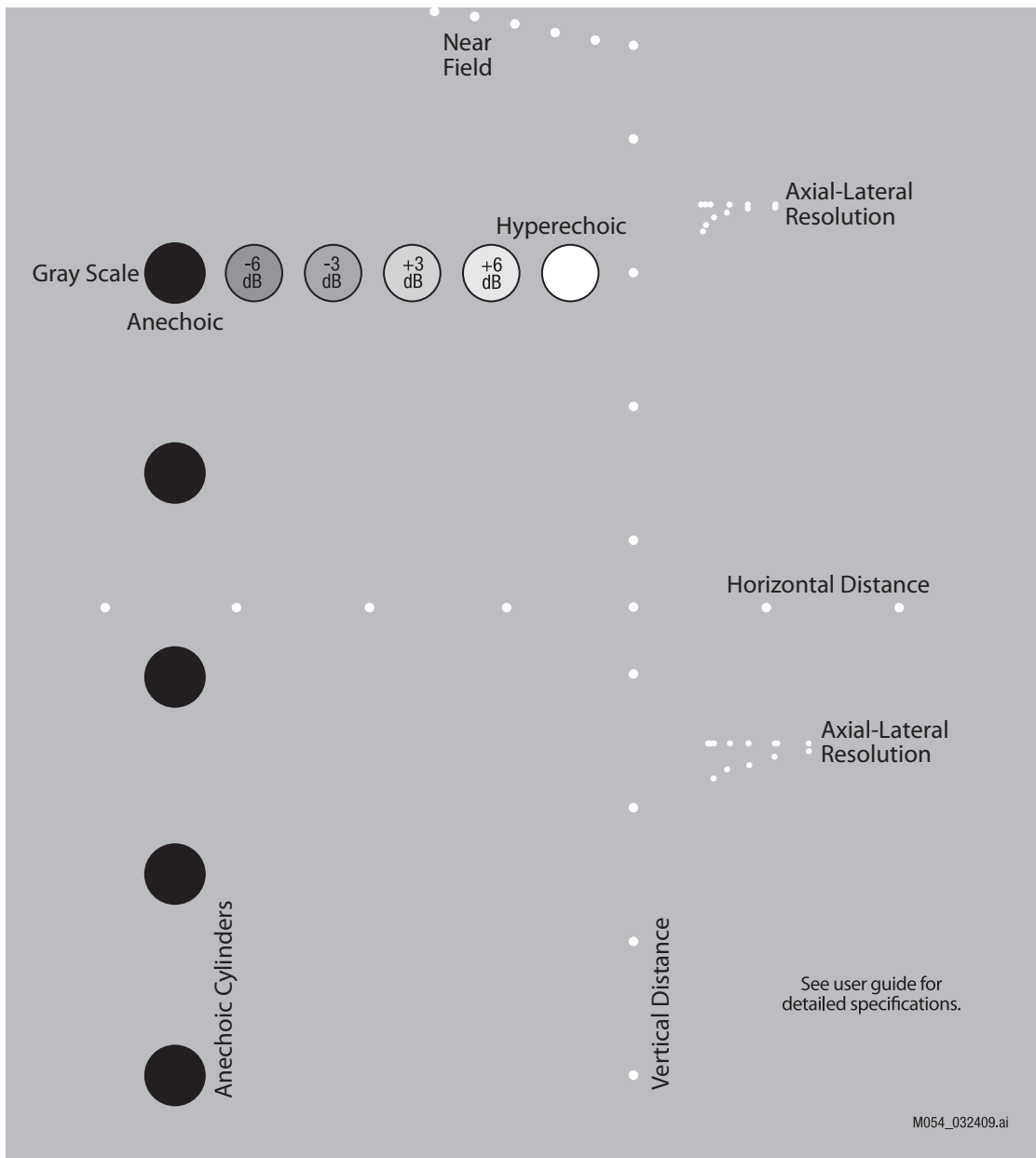
The Model 054GS was developed to provide a reliable tool for quality control checks on any ultrasound system. Unlike human subjects or random scannable material, this phantom offers a stable medium and contains specific, known test objects. The phantom is constructed from Zerdine<sup>®</sup> that simulates the acoustic properties of human soft tissue. It is housed in rugged ABS plastic for added durability. The phantom is designed to accommodate a wide variety of transducer shapes and frequencies.

The Model 054GS has a series of wire targets that will appear as bright dots or lines on the ultrasound image. These targets are made from nylon monofilament with a diameter of 0.1 mm and 0.08 mm.

CIRS<sup>®</sup> is certified to ISO 9001:2008 standards. We have an in-house test facility to measure acoustic properties of speed and attenuation. In addition, two ultrasound systems are used to assess relative contrast and visually inspect each phantom. As a result, every ultrasound phantom is subjected to thorough testing both during manufacture and upon completion. A Certificate of Compliance is issued with each phantom.

For further guidance on establishing a quality assurance program, you may want to reference the accreditation programs established by the ACR and AIUM. You can access this information at [www.acr.org](http://www.acr.org) or [www.aium.org](http://www.aium.org). If additional information is required, please call CIRS technical service at 1-800-617-1177.

## SPECIFICATIONS – MODEL 054GS



### PHANTOM HOUSING

Material

ABS

Outer Dimensions

17.8 x 12.7 x 20.3 cm (7 x 5 x 8")

### SCANNING SURFACE

Material

Saran-based laminate

Dimensions

14 x 9 cm (5.5 x 3.5")

**BACKGROUND MATERIAL**

Material	Zerdine
Speed of Sound	1540 m/s
Attenuation Coefficient	0.5 dB/cm-MHz
Other	Compatible with harmonic imaging

**WIRE TARGETS**

Material	Nylon monofilament
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**NEAR FIELD GROUP**

Number of targets	6
Diameter	100 microns
Depth range	1 to 6 mm
Vertical distance between targets	1 mm

**VERTICAL DISTANCE GROUP**

Number of targets	8
Diameter	100 microns
Depth range	2 to 16 cm
Vertical distance between targets	20 mm

**HORIZONTAL DISTANCE GROUP**

Number of groups	1
Diameter	100 microns
Depths	9 cm
Number of targets	7
Horizontal distance between targets	20 mm

**AXIAL / LATERAL RESOLUTION GROUPS**

Group 1	
Diameter	80 microns
Depths	3 cm
Axial & Lateral separation between targets	4, 3, 2, 1, 0.5 & 0.25 mm

Group 2	
Diameter	80 microns
Depths	11 cm
Axial & Lateral separation between targets	4, 3, 2, 1, & 0.5 mm

**ANECHOIC CYLINDERS**

Material	Zerdine
Number of Cylinders	5
Contrast	Anechoic
Diameter	8 mm
Depths	4, 7, 10, 13 & 16 cm

## GRAY SCALE TARGETS

Material	Zerdine
Number of Targets	6
Contrasts	Anechoic, -6 dB, -3 dB, +3 dB, +6 dB, & Hyperechoic
Diameter	8 mm
Depth	4 cm

## ACCESSORIES

Removable water well, Removable endocavity cover, Removable storage cover, Carry case, Certificate of Compliance, Model 054GS User Guide & Technical Information, and QA worksheet

## NOTES

All dimensions without tolerances are nominal

All measurements made at  $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$

All speed of sound and attenuation measurements made with 5 MHz focused transducer on batch samples using substitution method.

## ZERDINE®

The Model 054GS is constructed from a patented, solid elastic material developed at CIRS called Zerdine. Phantoms constructed from Zerdine will not melt or leak when punctured and they do not require refrigeration. Zerdine is also more elastic than other materials and allows more pressure to be applied to the scanning surface without subsequent damage to the material. At normal room temperatures, Zerdine will accurately simulate the ultrasound characteristics found in human liver tissue. Specific proprietary fabrication procedures enable close control over the homogeneity of Zerdine and the reliability of its acoustic characteristics from batch to batch.

The formulation system established at CIRS is geared to independently control:

- The speed of sound in the optimal range of 1510 to 1700 m/s.
- Attenuation in the optimal range of 0.05 and 1.5 dB/cm-MHz.
- Scatter or relative contrast in the optimal range of -15 to +15 dB in relation to a scatter baseline equivalent to human liver tissue.
- Elasticity with a Young Modulus in the optimal range of 4 to 90 kPa.

At normal room temperature, Zerdine response to ultrasonic excitations will simulate the ultrasonic response of human tissue. The relation between the acoustic attenuation,  $A$ , and the acoustic frequency,  $F$ , is of the form  $A = A_0 F^n$  with values of the power coefficient,  $n$ , in the range of 0.8 to 1.10, indicating the proportional increase of the acoustic attenuation with frequency. Backscatter characteristics can be adjusted through the addition of predetermined amounts of calibrated scatter material, and are fully compatible with harmonic imaging. Zerdine can be molded into very intricate shapes, and the material can be cured in layers allowing the production of “multi-tissue” phantoms. Zerdine, like most other phantom materials, will desiccate if unprotected; thus, all phantoms must be stored properly. If stored in the case provided, your phantom should last many years.

## ***USE OF THE REMOVABLE WATER WELL AND COVERS***

The phantom is shipped with the protective cover attached to the phantom. This can be removed by stretching the elastic latches on either side of the phantom up and off of the protective cover. The included water well and covers are easily secured to the phantom with these same rubber latches. Simply place the water well or cover on top of the phantom and stretch the elastic latches up and over the attachment point on either side of the accessory.

Coupling gel can be applied directly to the scan surface. This option is best used with linear transducers. If a curved array is utilized, coupling may be better with water and a removable water well is provided. Side Fire transducers can be particularly challenging to scan with a standard phantom. CIRS has designed a removable endocavity cover for these transducers. When this accessory is attached, the phantom should be placed on it's back and the cover should be filled with water.

When finished scanning it is best to clean the scan surface of any water or coupling gel and replace the protective cover.

## ***ESTABLISHING A BASELINE WITH YOUR NEW PHANTOM***

Please read the following sections of this manual carefully before embarking on your QA program, and do not hesitate to call our technical service number, 1-800-617-1177, if you have any questions.

Before performing routine quality assurance measurements, establish:

### 1. System settings for each measurement:

System setup can have a dramatic impact on the results obtained from quality assurance measurements. You must establish and record what system settings should be used for each of the quality assurance tests. These same settings should be used each time the test is performed. If not, then the conclusions drawn may not be valid.

### 2. Baseline measurements:

The first set of measurements taken will be the baseline measurements for that system. Record the system settings used to acquire each measurement along with your measurement results. On subsequent scans, refer to the baseline results to determine if the ultrasound system has drifted to an unacceptable level. It is each facility's responsibility to establish the magnitude of drift allowed before corrective action is warranted.

### 3. Allowable deviation from baseline measurements:

The difference between the original baseline measurements and subsequent measurement should be calculated and recorded. At some point the difference will be large enough that some action is required (call service, replace system, etc.). Each facility needs to determine the action level for each test. You should refer to the user's manual of your ultrasound scanner and note the stated accuracies of the system's general imaging measurements. These stated accuracies may greatly influence the conclusions made when evaluating the ultrasound system. For example, if the measurement accuracy for your system is 10% for distances up to 2 cm, the scanner may detect 2.0 cm as being anywhere from 1.8 cm to 2.2 cm and still be functioning properly. The user is responsible for establishing action levels.

### 4. Frequency of system assessment:

How often each system is evaluated is also up to each facility to determine. CIRS recommends at least annually.

For further guidance on establishing a quality assurance program, you may want to reference the accreditation programs established by the ACR and AIUM. You can access this information at [www.acr.org](http://www.acr.org) or [www.aium.org](http://www.aium.org). If additional information is required, please call CIRS technical service at 1-800-617-1177.

## ***ROUTINE QUALITY CONTROL MEASUREMENTS***

The Model 054GS can be used to assess:

- Uniformity
- Dead Zone
- Depth of Penetration
- Beam Profile/Focal Zone/Lateral Response Width
- Vertical Distance Measurement
- Horizontal Distance Measurement
- Axial Resolution
- Lateral Resolution
- Anechoic Masses
- Contrast Sensitivity

Using the correct instrument settings is also imperative to the proper evaluation of the ultrasound system. The following are general steps for imaging all targets.

- Some wires will appear as short lines rather than dots. When using the electronic calipers, always take measurements from a point on one echo to the same point on the next, i.e., center to center. Errors may be introduced otherwise.
- If a convex probe is used, center the target within the scan plane in order to minimize degradation and distortion introduced on the outer edges of the probe.
- When assessing vertical distance measurements, DO NOT press on the scanning surface. Pressure on the scanning surface causes the wires to become temporarily displaced. Vertical distance measurements will then be inaccurate.
- When assessing horizontal distance accuracy, ensure the scan plane is perpendicular to the horizontal target group. Rotation of the probe will result in inaccurate distances.
- Always be sure the phantom is scanned while at room temperature. A phantom just received may be colder or hotter than room temperature depending on where it was stored during shipping. Temperature affects the speed of sound and ultimately the perceived measurements. The phantom should be stored at room temperature for at least 24 hours before use to ensure its core temperature is correct.

## UNIFORMITY

Uniformity is defined as the ability of the machine to display echoes of the same magnitude and depth with equal brightness on the display. This is a good test to ensure all crystals within the transducer are functioning.

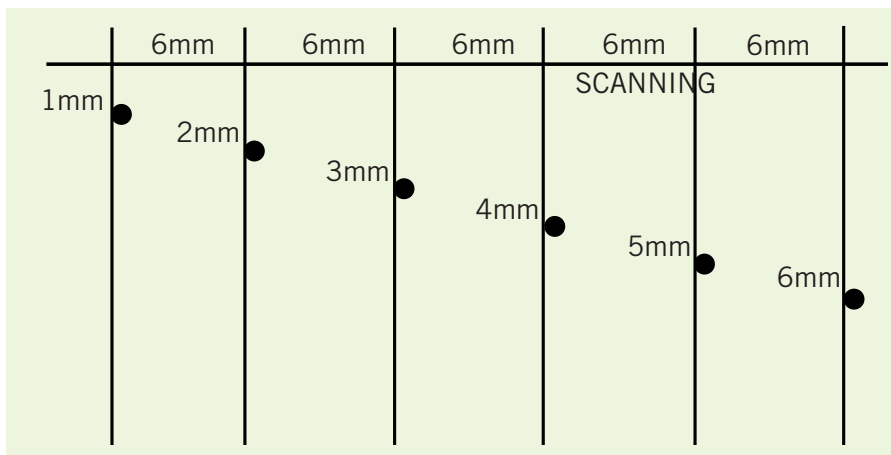
### Uniformity Testing Procedures

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer on the scanning surface in a region with a minimum number of targets.
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that the targets are maximized.
5. Freeze the image and obtain a hard copy.
6. Observe the general appearance of the phantom. Note if all regions at the same depth are displayed with the same intensity across the width of the image.
7. Record your observations.

## NEAR FIELD GROUP

The near field group assesses the distance from the front face of the transducer to the closest identifiable echo. This region, where no useful information is obtained, is commonly referred to as the “dead-zone” or “ring-down distance”. The dead-zone occurs because the ultrasound system cannot send and receive data simultaneously. It is instrument dependent and is diminished as frequency is increased. A change in your system’s dead-zone is indicative of a problem with the transducer, the pulsing system or both.

The near field target consists of parallel, 100 micron diameter, nylon monofilament wires horizontally spaced 6 mm apart from center to center (*Figure 1*). Vertical distance from the center of each wire to the top edge of the scanning surface ranges from 6 mm down to 1 mm in 1 mm increments.



**Figure 1 - Near Field Target**  
Wire Diameter - 0.1 mm

### *Near Field Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer above the near field resolution target and perpendicular to the wires. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) to maximize resolution in the near field. Record these settings for use on subsequent testing.
4. Freeze the image while the near field targets are clearly displayed.
5. Count how many wires of the near field target you can see. Subtracting this number from the total number of targets gives you the dead zone measurement.

Ex: total # of targets in group = 5

# of targets actually seen = 3

dead zone distance =  $5 - 3 = 2$  mm

An alternative method uses the electronic calipers to measure the distance between the transducer face and the closest wire target to be resolved from the reverberation. If the first target to be resolved is at 4 mm, then the dead zone distance is “something less than 4 mm”.

6. Record this distance and compare with baseline measurements.

## ***VERTICAL DISTANCE GROUP***

### **ATTENTION:**

To register accurate vertical distance measurements, **DO NOT APPLY PRESSURE TO THE SCANNING SURFACE!** We strongly encourage the user to scan the phantom with the water well filled with water or coupling gel so the transducer does not make direct contact with the scanning surface. As with a patient, even the slightest amount of pressure on the scanning surface will cause incorrect distances to be measured.

The Vertical Distance Group is useful for many different measurements. This group assesses the depth of penetration, beam profile, lateral response width, vertical distance calibration, and focal zone of an imaging system. A Vertical Plane is a plane perpendicular to the scanning membrane plane and perpendicular to the target wires.

### *Depth of Penetration*

Depth of penetration, also called maximum depth of visualization or sensitivity, is the greatest distance in a phantom for which echo signals due to the scatterers within the tissue-mimicking background material can be detected on the display. The depth of penetration is determined by the frequency of the transducer, the attenuation of the medium being imaged and the system settings.

### *Depth of Penetration Testing Procedures*

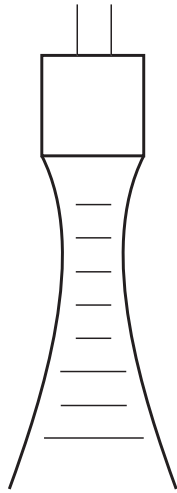
1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer to acquire an image of a vertical plane target. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the vertical targets are displayed at their maximum intensity level.
5. While actively scanning, look to see where the backscattered echoes within the background material disappear. Be careful not to confuse electronic noise with the background backscattered echoes. Electronic noise will move but back-scattered echoes will remain stationary while maintaining the transducer in a fixed position.
6. Freeze the image.
7. With electronic calipers measure the distance between the scanning surface and the last identifiable echoes due to scattering. **Note:** Usually the wires stay visible even though the backscattered echoes are not. Remember to measure the distance to the scattered echoes, not to the last visible wire.
8. Record this distance on a record sheet and compare with baseline depth.

### *Beam Profile, Focal Zone, and Lateral Response Width Testing Procedures*

The beam profile is the shape of the ultrasound beam. A typical beam profile is shown in *Figure 2*. The narrowest region within the beam profile is indicative of the focal point. By convention, the region surrounding the focal point with intensity within 3 dB of maximum is the focal zone. The best images are obtained while within the focal zone. The vertical wire target group is useful for determining the beam profile and the focal zone of a system.

### *Beam Profile, Focal Zone, and Lateral Response Width Testing procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer in a vertical plane. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the vertical targets are displayed at their maximum intensity level to insure the transducer is imaging a vertical plane.
5. Freeze the image and obtain a hard copy.
6. Some of the targets will appear as short horizontal lines rather than dots on the frozen image.



**Figure 2 - Typical Beam Profile**

7. Measure the horizontal length of the targets. These measurements represent the lateral response width of the system at the different depths and setup. The minimum length is indicative of the location of the focal point.
8. If a smooth curve is drawn to connect the edges of the targets, the beam profile is easily discernible.
9. If using a variable focused transducer, repeat the above procedure for several different focal zones (those settings most commonly used are recommended).
10. Record the focal point and save the hard copy.

### *Vertical Distance Calibration*

A vertical distance is defined as the distance along the axis of the beam.

### *Vertical Distance Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer in a vertical plane. (The wires should appear as dots, not lines). Do not apply excessive pressure as this may temporarily compress the target and skew the measurements.
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a "normal" liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the vertical targets are displayed at their maximum intensity level.
5. Freeze the image and obtain a hard copy.
6. Using electronic calipers measure the distances between two wires at various depths or align the echoes to the display markers for comparison.
7. Record these measurements.
8. Compare the measured values with the recorded baseline distances.

## **HORIZONTAL DISTANCE GROUP**

This target group is used to determine the accuracy of measurements made perpendicular to the beam axis and is critical for the same reasons as vertical distance measurements.

### *Horizontal Distance Testing Procedures*

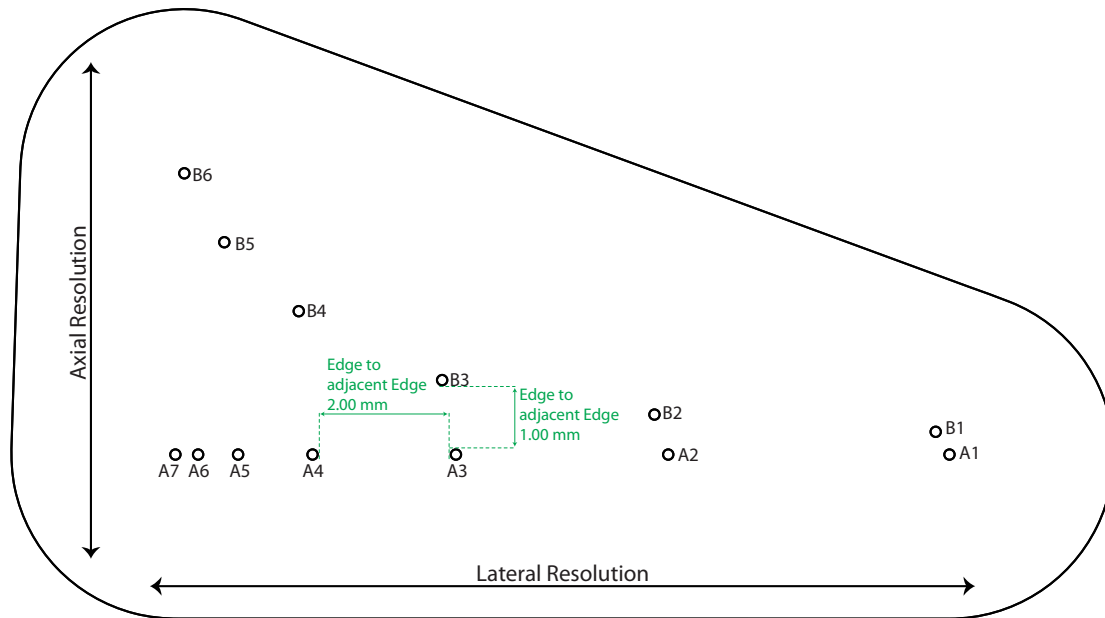
1. Fill the water trough with tap water.
2. Position the transducer in a vertical plane. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the horizontal targets are displayed at their maximum intensity level.
5. Freeze the image and obtain a hard copy.
6. Using electronic calipers, measure the distances between two wires along the horizontal plane.
7. Record these measurements.
8. Compare the measured values with the known distances between the targets.

## AXIAL / LATERAL RESOLUTION GROUPS

Axial resolution is defined as the ability of an ultrasound system to resolve objects in close proximity along the axis of the beam. In other words, how close can two objects be along the axis of the beam and still be detected as two distinct objects? Axial resolution is proportional to the length of the system's transmitted ultrasonic pulse or pulse length.

Lateral resolution is similar to axial resolution except it is concerned with the resolution perpendicular to the beam axis. Lateral resolution will improve with a narrowing of the beam width. Therefore, within the focal zone, the lateral resolution will be at its best.

The Model 054GS has two combined axial and lateral resolution target groups. The first group, at a depth of 3 cm, is designed for probes of 5 MHz and above. It consists of 13 parallel nylon wires of 80 microns diameter. In *Figure 3* they are labeled from A1 to A7 to assess the lateral resolution and B1 to B6 to assess the axial resolution. *Table 1* shows which wires to use to assess the various distance resolution.

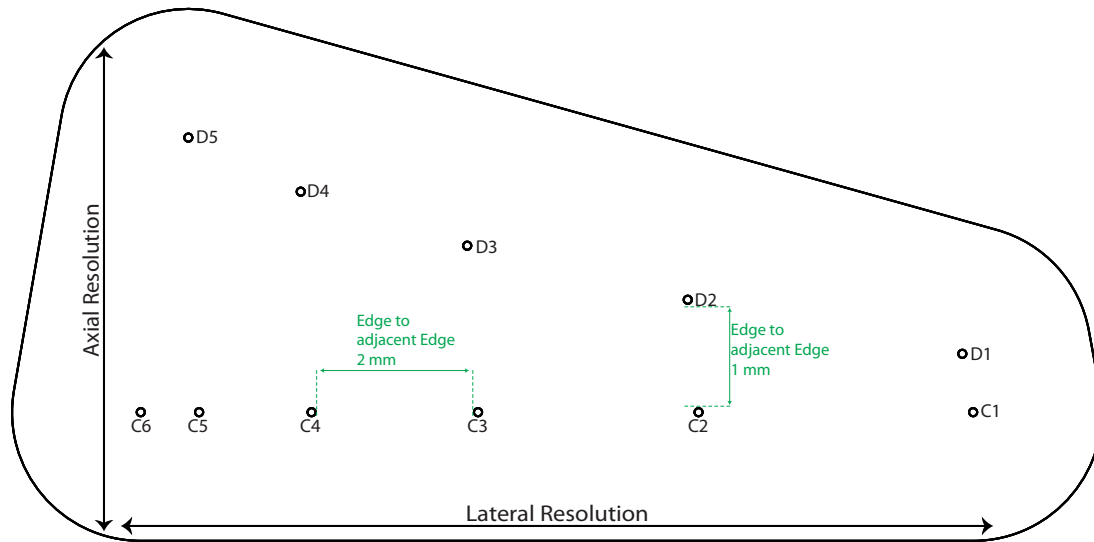


*Figure 3 - Combined Axial/Lateral Resolution Targets at 3 and 6.5 cm depth*

		Targets					
		A1-B1	A2-B2	A3-B3	A4-B-4	A5-B5	A6-B6
Axial Resolution (mm)		0.25	0.5	1.0	2.0	3.0	4.0
		Targets					
		A1-A2	A2-A3	A3-A4	A4-A5	A5-A6	A6-A7
Lateral Resolution (mm)		4.00	3.0	2.0	1.0	0.5	0.25

*Table 1 - Assessing Distance Resolution*

The second target is located at 11 cm depth for evaluation of low frequency probes. It consists of 11 parallel nylon wires of 80 microns diameter. In *Figure 4* targets are labeled from C1 to C6 to assess the lateral resolution and D1 to D5 to assess the axial resolution. *Table 2* shows which wires are used to assess the various distance resolution.



**Figure 4 - Combined Axial/Lateral Resolution Targets at 10.5 cm depth**

	<b>Targets</b>				
	C1-D1	C2-D2	C3-D3	C4-D4	C5-D5
<b>Axial Resolution (mm)</b>	0.5	1.0	2.0	3.0	4.0
	<b>Targets</b>				
	C1-C2	C2-C3	C3-C4	C4-C5	C5-C6
<b>Lateral Resolution (mm)</b>	4.0	3.0	2.0	1.0	0.5

**Table 2 - Assessing Distance Resolution**

*Axial or Lateral Resolution Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer above the axial resolution targets in a vertical plane. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the targets are displayed at their maximum intensity level.
5. Freeze the image and obtain a hard copy.
6. Examine the image to determine the last pair of wires to be distinguished as two separate entities. If the last pair of wires to be resolved is separated by a distance of 1 mm then record the axial resolution as being “in between 0.5 mm and 1.0 mm”.

Lateral resolution is similar to axial resolution except it is concerned with the resolution perpendicular to the beam axis. Lateral resolution will improve with a narrowing of the beam width. Therefore, within the focal zone, the lateral resolution will be at its best.

The lateral resolution targets are positioned at depths of 3 and 11 cm. Six parallel wires are horizontally spaced at distances of 4, 3, 2, 1, 0.5 and 0.25 mm from edge to edge at the 3 cm depth. At the 11 cm depth, six parallel wires are horizontally spaced at distances of 5, 4, 3, 2 and 1 mm. These targets are designed to accurately assess the lateral resolution of the imaging system.

#### *Lateral Resolution Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer above the axial resolution targets in a vertical plane. (The wires should appear as dots, not lines).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that all the targets are displayed at their maximum intensity level.
5. Freeze the image and obtain a hard copy.
6. Examine the image to determine the distance between the last two wires as to be resolved as two distinct objects.
7. Record this distance as the lateral resolution.

### **ANECHOIC CYLINDERS**

Machines have a tendency to represent low-contrast structures smaller than they actually are and with irregular rather than smooth borders, this is referred to as fill-in. It is desirable for these effects to be minimal.

In the Model 054GS, five cylinders having no scatter are provided in the phantom to test a machine's ability to image cyst-like structures over range of depths. The cylinders are 8 mm in diameter and located at depths of 4, 7, 10, 13, and 16 cm. Refer to the target diagram attached to your phantom. The accuracy of the machine's representation of the mass (proper size and shape) may be determined using this target. Because of the low attenuation in this mass, you may notice enhancement behind the target.

### *Anechoic Cylinders Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer above the cyst and perpendicular to the wires. You should be imaging the circular cross section of the cylinder.
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that the target is maximized.
5. Freeze the image and obtain a hard copy.
6. Observe the general appearance of the tumor. Note if you are able to see the mass.
7. A more detailed analysis can be performed by measuring the width and height of the mass.
8. Record your observations.

## **GRAY SCALE TARGETS**

In the Model 054GS, six cylinders having contrast ranging from anechoic to hyperechoic with respect to the background material are provided in the phantom to test a machine's dynamic range. The cylinder diameter is 8 mm at a depth of 4 cm. These masses are useful in determining the ultrasonic system's capability of distinguishing targets of varying gray scale levels. The accuracy of the machine's representation of the mass (proper size and shape) may also be determined using this target. Refer to target diagram attached to your phantom.

### *Gray Scale Targets Testing Procedures*

1. Apply coupling gel to the scanning surface or fill the water trough with tap water.
2. Position the transducer above the tumor and perpendicular to the wires. (The tumor should appear as a circular region).
3. Adjust the instrument settings (gain, TGC, output, etc.) as for a “normal” liver technique. Record these settings for use on subsequent testing.
4. Align the probe so that the target is maximized.
5. Freeze the image and obtain a hard copy.
6. Observe the general appearance of the tumor. Note if you are able to see the mass.
7. A more detailed analysis can be performed by measuring the width and height of the mass.
8. Record your observations.

## **ANALYSIS**

It is recommended that all these measurements be performed at the most frequently used imaging arrangements. The importance of these tests is not so much from a one-time analysis as it is to make sure the system performance remains constant over an extended period of time. All these measurements may also be used to compare the performance of various setups of the same machine or to compare different machines with one another in a quantitative manner.

**Note:** Time-gain properties and sector scanner errors can be evaluated using the vertical plane target in accordance with suggested AIUM techniques. For targets with minimum scattering, lower gain levels can be used; however, higher gain settings enable evaluation at more clinical type settings. When evaluating any machine, settings should be recorded and remain consistent over time. For further instruction on measuring performance refer to Standard Methods for Measuring Performance of Pulse-Echo Ultrasound Imaging Equipment, AIUM Standards Committee, July 1990.

## ***CARE AND HANDLING***

- When all testing is complete, remove excess coupling material, replace the protective carrying case cover and return phantom to carrying case.
- The scanning surface is the most important item on the phantom to protect. It can withstand normal scanning pressure but DO NOT press on the scanning surface with your fingernails or any other sharp objects.
- The phantom may be cleaned with mild soap and water ONLY. Avoid solvent-based, alcohol-based, or abrasive cleaning agents.
- For longest life, the phantom should be stored at room temperature. The phantom SHOULD NOT be subjected to freezing or boiling conditions such as those encountered in the trunk of a car during a South Dakota winter or Arizona summer. The most accurate measurements will be made with the phantom  $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $70^{\circ}\text{F} - 73^{\circ}\text{F}$ ).
- Always store the phantom with the removable storage cover attached and in the air-tight carry case provided to maximize life expectancy.
- At least once a year, weigh your phantom and compare to original weight noted on certificate of compliance. If phantom has lost or gained more than 1% of its original weight and you notice a difference in vertical distance measurements, or the scan surface appears depressed, call CIRS at (800) 617-1177

### **IN THE EVENT OF DAMAGE TO THE SCANNING SURFACE OR ABS BOX, FOLLOW THESE INSTRUCTIONS TO AVOID IRREVERSIBLE DAMAGE TO PHANTOM:**

1. Immediately seal phantom in airtight container (plastic bag, carrying case).
2. Contact technical service at (800) 617-1177 for return information.