Quality Control for ULTRASOUND

Gammex

GAMMEX RMI®

ULTRASOUND

Benefits of GAMMEX RMI Tissue Mimicking Phantoms

QUALITY

Gammex RMI ultrasound phantoms are recognized as the standard for quality and performance in the ultrasound labs of hospitals, clinics and ultrasound equipment manufacturers. Sophisticated technology in Tissue Mimicking (TM) phantoms meets the requirements of all current quality assurance recommendations.

Our phantoms offer convenient, easy to use features which provide an objective baseline needed to detect minor changes and monitor the overall performance of imaging equipment. You can use the same settings for phantom imaging as you would for patients in any clinical situation.

GAMMEX RMI prides itself on high quality products with reproducible results. Superior quality, uniformity, accurate attenuation, echogenicity, speed of sound and freedom from artifacts make our phantoms the best instrument for assuring the integrity of your ultrasound systems. Image quality indicators measure the systems performance characteristics that affect the diagnostic value of the ultrasound image.

DESIGN

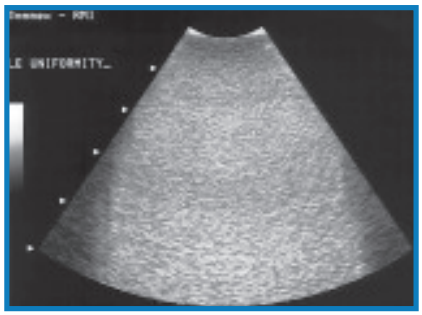
The RMI design for ultrasound phantoms is based on sound scientific principle. Targets in each phantom are spaced to meet specific sonographic requirements, and are developed using recommendations by the American Institute of Ultrasound in Medicine (AIUM), the National Council on Radiation Protection (NCRP), and the American Association of Physicists in Medicine (AAPM). These designs increase operator convenience and testing reliability while decreasing costs.

TISSUE MIMICKING GEL

The heart of the RMI phantom is the tissue mimicking material. Tissue mimicking material has the same attenuation and speed of sound as human soft tissue with uniform scatter distribution that yields a smooth image texture. The tissue-like attenuation and echogenicity of tissue mimicking phantoms allows the testing of ultrasound systems using actual clinical settings. TM phantoms provide attenuation consistent with soft tissue over a wide range of transducer frequencies and system configurations. These characteristics provide accurate ultrasound measurements for better image quality tests of all ultrasound scanning systems.

LE PHANTOM SERIES

Our ultrasound engineers have developed a new Tissue Mimicking (TM) gel which provides a smoother background texture than conventional TM gels (see scan image below). This gel reduces the backscatter that is inherent in conventional TM gels and is fully compatible with the latest in Tissue Harmonics equipment and technology. In addition, the LE phantom series has a composite film scanning surface that has improved transmission properties so more of the ultrasonic beam can be transmitted and received.



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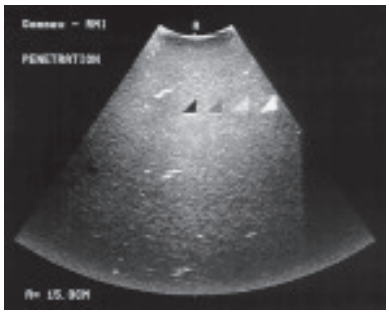
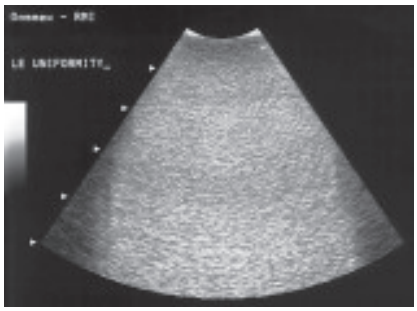
B-Mode Image Quality Indicators

Depth of Penetration



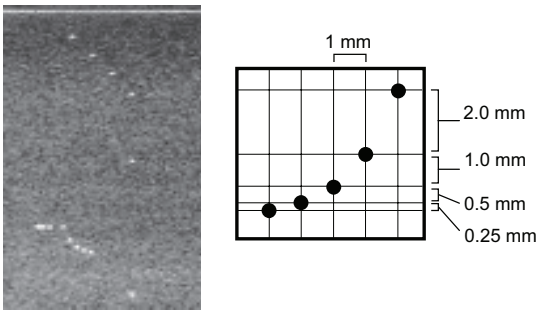
The point at which usable tissue information disappears or maximum depth of penetration is reached, can be defined simply as how far one can "see" into the phantom. Equipment sensitivity and noise determines the deepest echo signal which can be detected and clearly displayed.

Image Uniformity



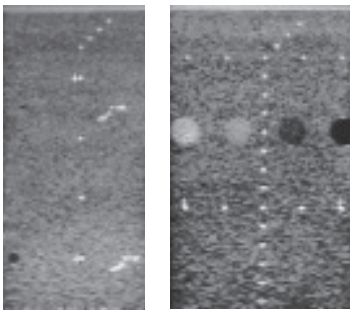
Ultrasound systems can produce various image artifacts and non-uniformities which in some cases mask variations in tissue texture. Common non-uniformities are horizontal bands in the image caused by inadequate handling of transitions between focal zones or vertical bands indicating inactive or damaged transducer elements.

Axial Resolution



Axial resolution describes the scanner's ability to detect and clearly display closely spaced objects that lie on the beam's axis. Using pin targets of decreased vertical spacing, the system's axial resolution is determined by locating the two resolvable pins with the smallest separation.

Distance Accuracy



Vertical and horizontal distance measurement errors can easily go unnoticed on clinical images. Distance accuracy as a quality indicator is determined by comparing the measured distance between selected pin targets in the phantom with the known distance.

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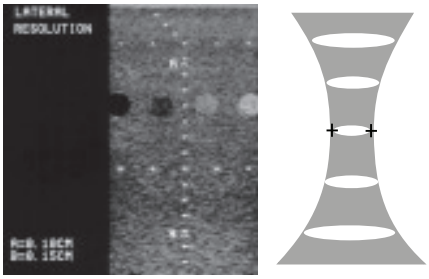
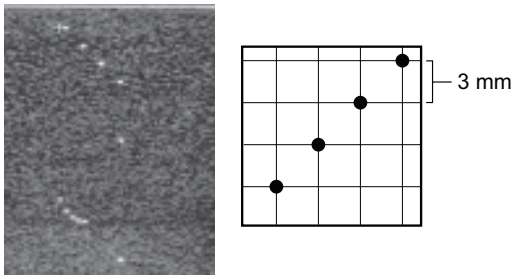
Using a Tissue Mimicking Phantom

Lateral Resolution



Lateral resolution is described as the distinction of small adjacent structures perpendicular to the beam's major axis. The lateral resolution is measured indirectly by measuring the width of pin targets at depths corresponding to the transducer's near, mid, and far field ranges.

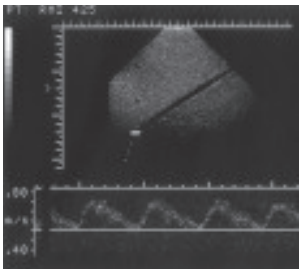
Dead Zone



The dead or "ring down" zone is the portion of the image directly under the transducer where image detail is missing or distorted. The depth of an instrument's dead-zone is determined by identifying the shallowest pin target that can be clearly visualized.

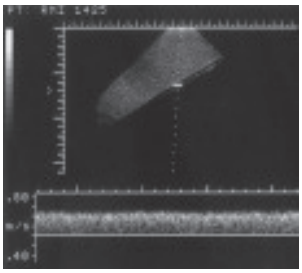
Doppler Ultrasound Quality Indicators Using a Doppler Flow System

Depth of Penetration



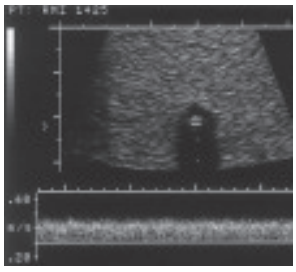
Using Doppler signals within a specified frequency range, the displayed image illustrates the weakest echo signal detectable above electronic noise. Again, an indication of how far you can "see" into patient tissue.

Directional Discrimination



By forming Doppler signals into two different electrical channels, 90° out of phase, flow away from or toward the transducer is determined. Inadequate discrimination between channels appears as bi-directional even though flow is in one direction.

Registration of Flow



Registration indicates the position accuracy of the sample volume cursor of a Doppler image. The strongest and highest velocity signal is expected at the center of the vessel. When the sample volume position is inaccurate on Doppler images, the strongest signal is off-center.

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Gammex RMI Ultrasound Phantom Comparison Chart

Phantom	Axial and Lateral Resolution Targets	Vertical Distance Calibration	Horizontal Distance Calibration	Anechoic Cysts	Depth of Penetration	Water Dam	Cylindrical Greyscale Targets	Triangular Greyscale Targets	Dead Zone Targets	Small Parts	Doppler Flow	Notes
403 LE	✓	✓	✓	✓	✓	✓			✓			Convertible Water Dam
403GS LE	✓	✓	✓	✓	✓	✓	✓		✓			Convertible Water Dam
404 LE	✓	✓	✓	✓	✓	✓			✓	✓		Convertible Water Dam
404GS LE	✓	✓	✓	✓	✓	✓	✓		✓	✓		Convertible Water Dam
405GSX LE	✓	✓	✓	✓	✓	✓		✓	✓			Convertible Water Dam
1425A LE	✓	✓	✓	✓	✓	✓					✓	Stationary Water Dam Constant and Pulsatile Flow Modes
411 LE	✓	✓	✓	✓	✓	✓			✓			Stationary Water Dam 1 Anechoic Cyst

Quality Indicators and Features

LE Tissue Mimicking Material

This gel is very uniform in appearance and has a nonlinear parameter (B/A) which matches human liver tissue almost exactly. LE Series phantoms are ideal for B-mode, Doppler and Tissue Harmonic Imaging systems.

Anechoic Cysts

The three different diameters represent blood vessels in human tissue and are useful for basic imaging tests.

Axial and Lateral Resolution Targets

Groups of nylon monofiliments for testing the axial and lateral resolution of ultrasound systems.

Greyscale Targets

These enable the user to determine how well their scanner can differentiate between different contrast densities. Choose from either the standard cylindrical targets or triangular targets. Cylindrical targets are ideal for basic scanning configurations, while the more challenging triangular targets are designed for testing high resolution scanners.

Doppler Flow

For testing ultrasound systems with Doppler capabilities. Flow choices include constant and pulsatile modes with calculated velocities.

Dead Zone Targets

These targets are used for measuring the depth of the scan head's "dead zone".

Vertical and Horizontal Distance Calibration

For checking the accuracy of the electronic calipers.

Composite Film Scanning Surface

A new material which prevents dessication and has improved transmission characteristics.

Water Dam

Enables water to be used as a coupling medium. Convertible water dams allow the user to move the dam out of the way in order to use gel as a coupling medium.