FREQUENCY SPECTRUM SHIFTS OF ULTRASOUND ECHOES
AS A FUNCTION OF DEPTH IN A FEMALE BREAST

Elizabeth Kelly-Fry*, Steven T. Morris**, Narendra T. Sanghvi**, and Ernest L.
Madsen***.
*Indiana Univ. Sch. of Medicine, **Labsonics, Inc., ***University of Wisconsin.

Knowledge of the changes in waveform characteristics as an ultrasound wave
penetrates multiple layers of soft tissues within a breast can be important for
both detection and diagnosis of breast pathologies by ultrasound mammography tech-
niques. Using a spectrum analyzer system in combination with an automatic, bi-
plane scanning, B-mode breast imaging unit, techniques were developed for recording
the center frequency and bandwidth characteristics of signals received from the
subcutaneous fat, mid-breast, retroommary, and pectoralis muscle regions of the
breast of a post-menopausal subject. The same techniques were applied to a breast
phantom that has internal architectural features and acoustic parameters (density, speed, attenuation coefficient) that are comparable to those of a normal breast.
A single focus, 7.5-MHz transducer was used for most of the recorded data. Lower
frequency transducers were also used. Spectral analysis data accompanied by relevant
breast and phantom images will be presented. [Work supported by Indianapolis
Center for Advanced Research and Labsonics, Inc.]

Results Presented

<table>
<thead>
<tr>
<th>Depth of Breast</th>
<th>Return Signal Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 cm (Fat)</td>
<td>7.5 MHz</td>
</tr>
<tr>
<td>2.4 cm</td>
<td>5.0 MHz</td>
</tr>
<tr>
<td>3.4 cm</td>
<td>4.0 MHz</td>
</tr>
<tr>
<td>4.1 cm (Muscle)</td>
<td>3.0 MHz</td>
</tr>
</tbody>
</table>


Prof. Elizabeth Kelly-Fry: Ind. Univ. Sch. of Med., Wishard Memorial Hospital,
Department of Radiology, 1001 West 10th Street, Indianapolis IN., 46202