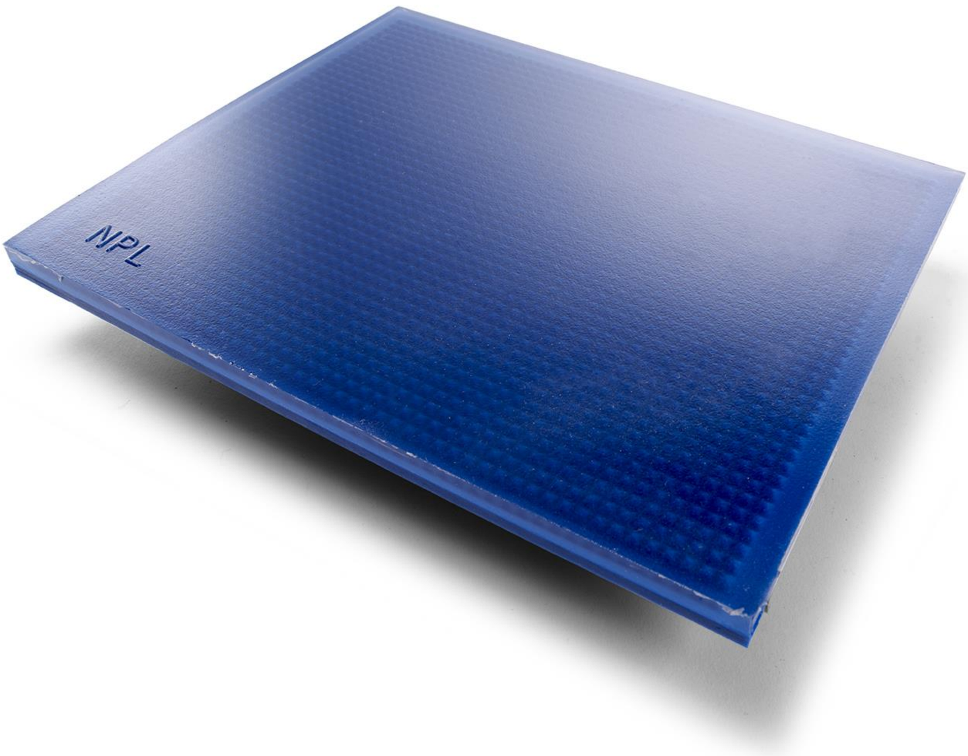
PRECISION ACOUSTICS

HAM A



HAM A, from Acoustic Polymers Ltd is a two-layer absorbing tile with an impedance matching front layer on top of a micro-bubble filled, pre-cast polyurethane absorbing layer. The interface between the two layers has a pyramidal wedge structure to reduce specular reflections and provide geometrical acoustic impedance matching between the two materials. HAM A has a density and wavespeed similar to that of water and is designed to exhibit good acoustic absorption particularly at ultrasonic frequencies above 1 MHz.

THIS COMBINATION OF PROPERTIES PRODUCES A MATERIAL THAT CAN BE USED IN AREAS SUCH AS:

- Absorbing targets for radiation force balances (up to 20 W)
- Bounded output masks/apertures for restricting radiating aperture
- Coating water tank fixtures to prevent unwanted reflections during ultrasonic measurements

The system exhibits excellent chemical resistance to a wide range of media.

HAM A is part of a family of high frequency acoustic absorbers and provides the highest fractional power dissipation of materials in the range.

TYPICAL PROPERTIES

Appearance	Two-layer polyurethane sheet: Clear upper layer acoustic impedance matched to water; Blue highly absorbing lower layer
Dimensions of standard tile	250 mm x 200 mm x 14 mm
Shore A hardness	78 ± 3
Density	1010 ± 20 kg / m^3
Average wave speed (1 MHz to 10 MHz)	1500 ± 30 m / s
Acoustic impedance	1.5 MRayls
Resistant to	Isopropyl Alcohol (IPA) Tricholethylene
Affected by	Ketones (MEK, Acetone) – Swell Dichloromethane – Swell and break down
Avoid prolonged exposure to	Ozone UV
Stability	Very stable due to cross-linked nature of polymer
Coefficient on Thermal Expansion	200 ppm/°C

HAM A AND THE MEASUREMENT OF ULTRASONIC POWER

Ultrasonic power is a key quantity required for acoustic output measurements of medical ultrasonic equipment. These are conventionally made using the radiation force principle and many commercially available balances use reflecting targets, even though application of such targets can lead to errors of up to 20% for highly diverging transducers fields. Reflecting targets may also be impractical for measurements on linear array transducers, where their physical dimensions may be smaller than the ultrasonic beam. The availability of HAM A means that radiation force balances will now be able to employ absorbing targets, overcoming or minimising these problems. HAM A fully meets the requirements within IEC 61161 for radiation force balance targets within the frequency range 1 to 20 MHz.

For high power applications, significant temperature rises can be generated within the absorber material. The thermal tolerance of HAM A has been assessed and the material can readily be used to complete measurements up to 20 Watts, where exposure times are no greater than 10 seconds. Should heating be a problem in your application, AptFlex F28P is recommended. The absence of the upper layer from AptFlex 28P allows water to cool the absorber and thus higher powers can be used.

INSERTION LOSS

Insertion loss (IL) is defined as

$$\mathrm{IL} = -20\log_{10}\left(\frac{P_t}{P_i}\right)$$

where P_t is the amplitude of the acoustic pressure transmitted through a sample and P_i is the amplitude of the acoustic pressure incident upon it.

This has been experimentally determined for a 14 mm thick sample of HAM A, and this is shown in Figure 1.

The dynamic range of the IL measurement is approximately 60 dB and values higher than this cannot be guaranteed.

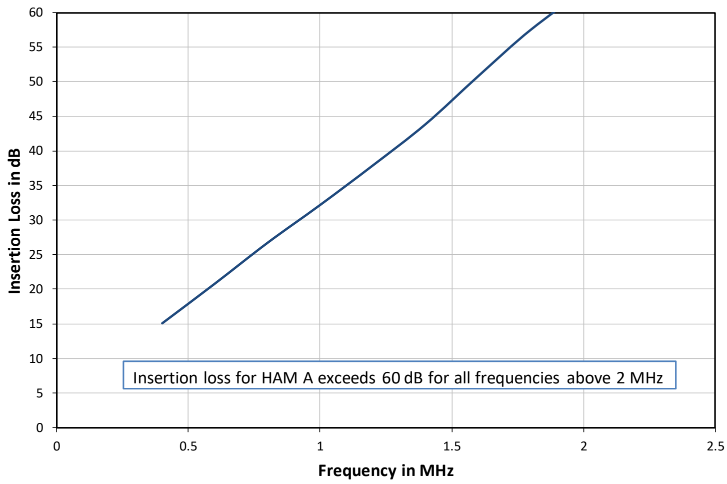


Figure 1 – Insertion loss vs Frequency for HAM A

ECHO REDUCTION

Echo Reduction (ER) is defined as

$$\mathrm{ER} = -20\log_{10}\left(\frac{P_r}{P_i}\right)$$

where P_r is the amplitude of the acoustic pressure reflected from a sample and P_i is the amplitude of the acoustic pressure incident upon it.

This has been experimentally determined for two samples of HAM A, and this is shown in Figure 2.

The dynamic range of the ER measurement is approximately 60 dB and values higher than this cannot be guaranteed.

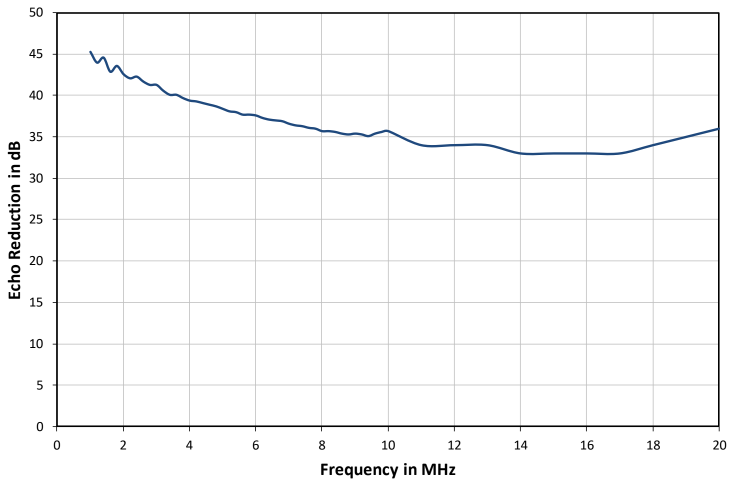


Figure 2 – Echo Reduction vs Frequency for HAM A

All data relating to the ER and IL of HAM A has been provided by the NPL (London).

FRACTIONAL POWER DISSIPATION

Fractional power dissipation (FPD) is defined as

$$\mathrm{FPD} = 1 - \left(\frac{P_r}{P_i}\right)^2 - \left(\frac{P_t}{P_i}\right)^2$$

where P_r is the acoustic pressure reflected from the sample, P_t is the acoustic pressure transmitted through the sample and P_i is the acoustic pressure incident upon the sample. This has been derived from the ER and IL measurements for HAM A, and this is shown in Figure 3.

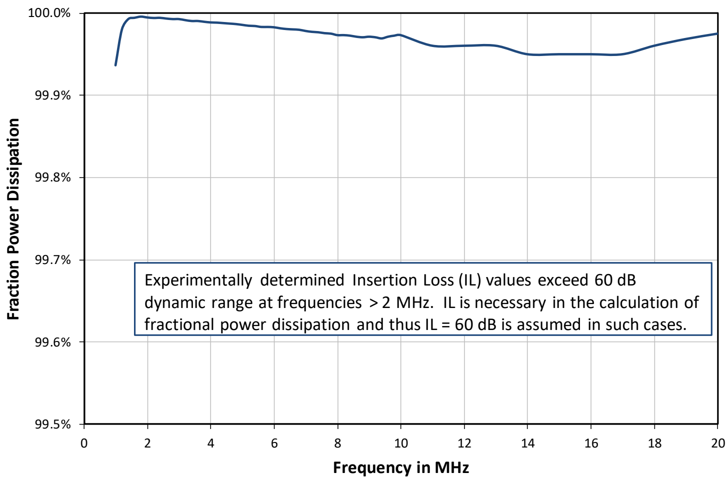


Figure 3 – Fraction Power dissipation vs Frequency for HAM A

All information is based on results gained from experience and tests, and is believed to be accurate but is given without acceptance of liability for loss or damage attributable to reliance thereon as conditions of use lie outside the control of Precision Acoustics Ltd or Acoustic Polymers Limited.