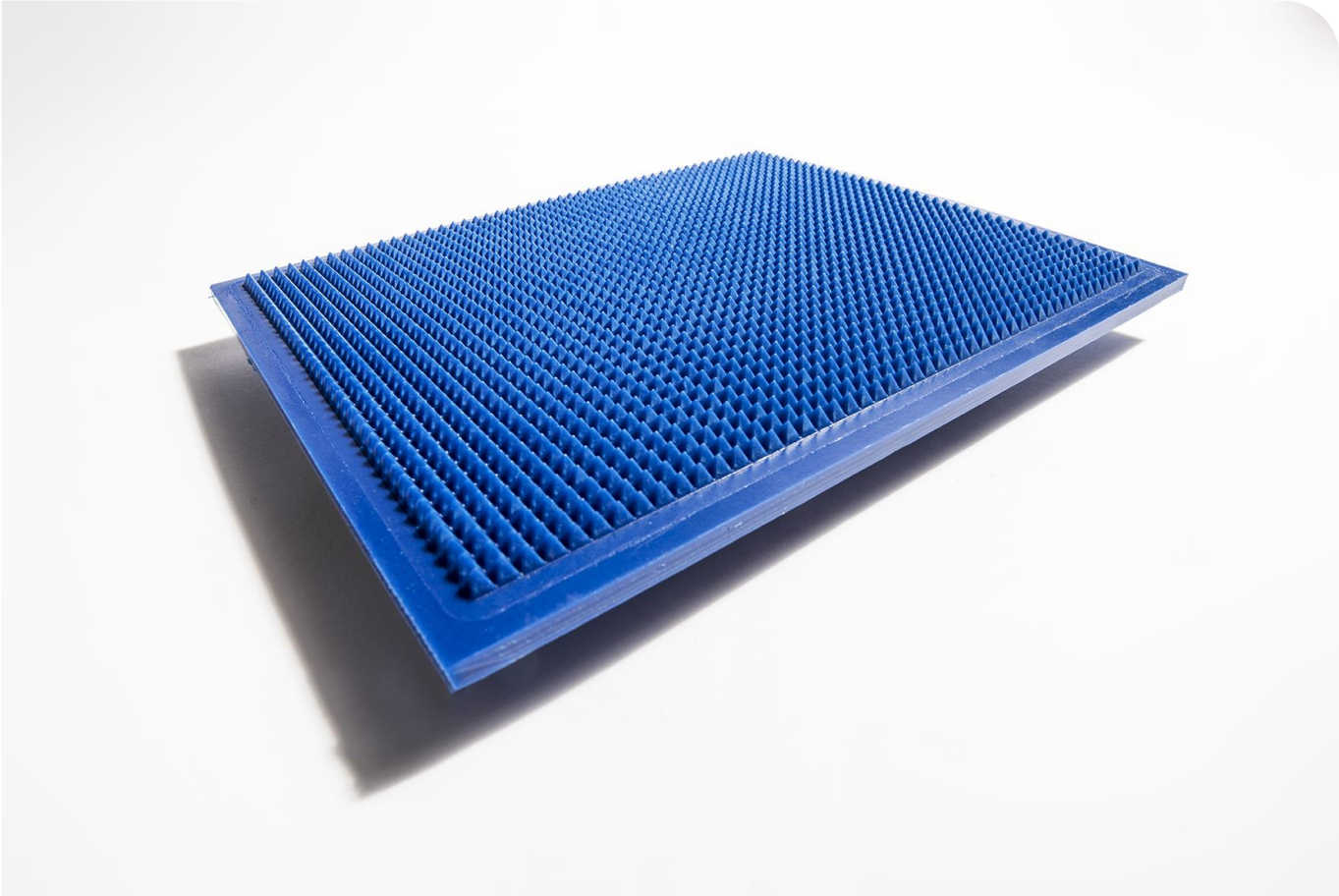
PRECISION ACOUSTICS

AptFlex F28P



AptFlex F28P, from Acoustic Polymers Ltd is a micro-bubble filled, pre-cast polyurethane sheet with density and wavespeed similar to that of water. It is designed to exhibit good acoustic absorption particularly at ultrasonic frequencies above 1 MHz.

AptFlex F28P has a pyramidal wedge structure on its outer surface to reduce specular reflections and provide geometrical acoustic impedance matching.

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

- Absorbing targets for radiation force balances (up to 200 W)
- Bounded output masks/apertures for restricting radiating aperture
- Anechoic linings of small ultrasonic measurement tanks
- Coating water tank fixtures to prevent unwanted reflections during ultrasonic measurements

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

AptFlex F28P is part of a family of high frequency acoustic absorbers and provides high levels of echo reduction, particularly at higher powers. Whilst AptFlex F28P has good levels of insertion loss, other high frequency absorbers within the range provide higher insertion loss.

TYPICAL PROPERTIES

Appearance	Dark blue polyurethane sheet
Dimensions of standard tile	250 mm X 200 mm X 10 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

APTFLEX F28P 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 AptFlex F28P means that radiation force balances will now be able to employ absorbing targets, overcoming or minimising these problems. AptFlex F28P fully meets the requirements within IEC 61161 and IEC 62555 for radiation force balance targets within the frequency range 1 to 20 MHz.

INSERTION LOSS

Insertion loss (IL) is defined as

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

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 10mm thick sample of AptFlex F28P, and this is shown in Figure 1.

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

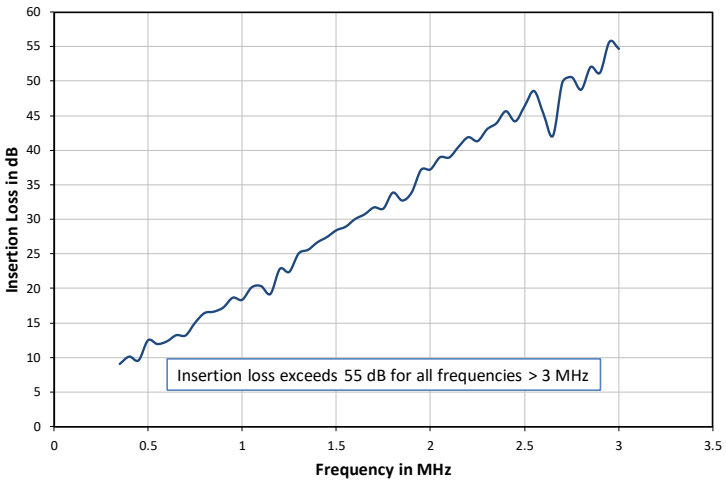

Figure 1 – Insertion loss vs Frequency for AptFlex F28P

ECHO REDUCTION

Echo Reduction (ER) is defined as

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

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 AptFlex F28P, and this is shown in Figure 2.

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

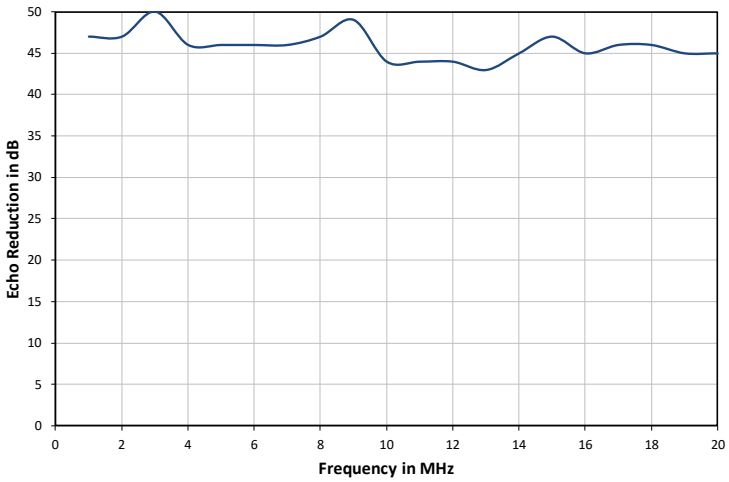

Figure 2 – Echo Reduction vs Frequency for AptFlex F28P

All data relating to the ER and IL of AptFlex F28P 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 AptFlex F28P, and this is shown in Figure 3.

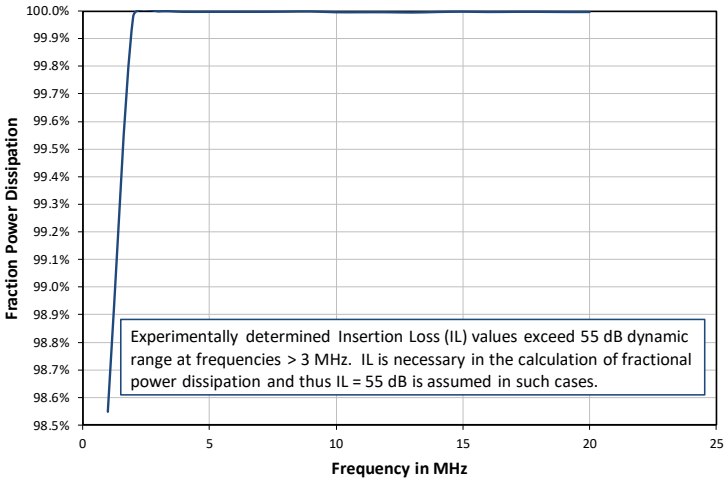

Figure 3 – Fraction Power dissipation vs Frequency for AptFlex F28P

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