# PRECISION ACOUSTICS

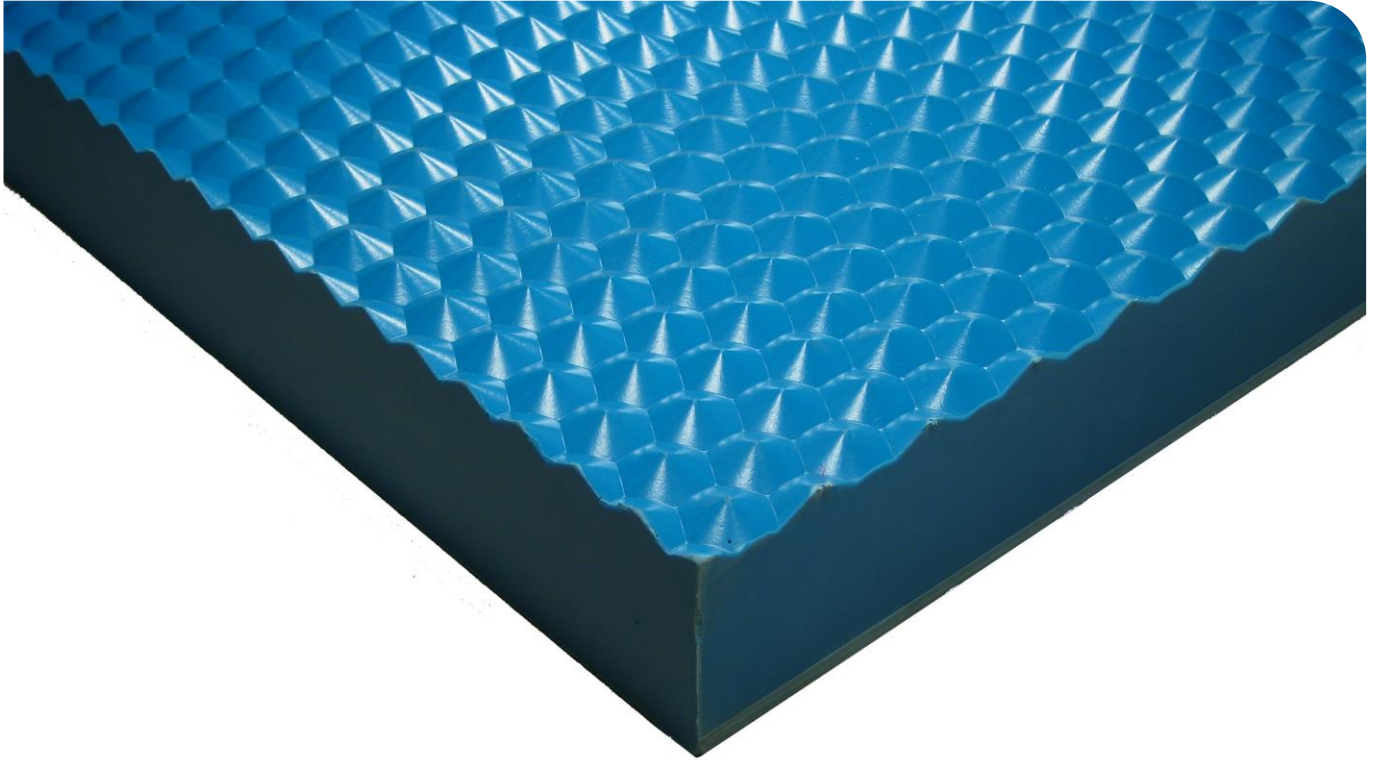## Apltile SF5048



Apltile SF5048, from Acoustic Polymers Ltd, is a single ply acoustic absorbing tile with a structured outer surface designed to meet the requirements of applications in frequency range 20 kHz to 200 kHz.  It is a micro-bubble filled, pre-cast polyurethane tile that has high levels of both echo reduction and insertion loss.

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

- A high-performance solution for large-scale application as anechoic linings of ultrasonic measurement tanks.
- Acoustic baffles for de-coupling and isolation of lower frequency ultrasonic waves.

Apltile SF5048 is part of a family of low frequency acoustic absorbers and provides a high-performance material optimised for frequencies < 200 kHz. Apltile SF5048 has the best echo reduction within the range and offers good insertion loss above 50 kHz. Other tiles within the range offer slightly better performance insertion loss below 50 kHz.

## TYPICAL PROPERTIES

| | |
|---|---|
| Appearance | Pale blue polyurethane sheet |
| Dimensions of standard tile | 600 mm x 600 mm x 50 mm |
| Density | 2100 ± 30 kg / m$^3$ |
| Mass of standard tile | 37.8 kg |
| Shore A hardness | 87 ± 3 |
| Average wave speed (50 kHz to 200 kHz) | 990 ± 30 m / s |
| Acoustic impedance | 2.1 MRayls |
| Resistant to | Isopropyl Alcohol (IPA) |
| | Trichloroethylene |
| 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 of linear thermal expansion | 200 ppm / °C |

## 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.

Due to the frequency range of interest for Apltile SF5048 $IL$ has been characterized in two experimental configurations:

1. As an unbacked tile over the range 20 kHz to 200 kHz as shown in Figure 1.
2. Mounted on a 5 mm steel backing plate over the range 2 kHz to 50 kHz as shown in Figure 2.

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



Insertion loss for SF5048 exceeds 60 dB for all frequencies >150 kHz.

**Figure 1** – Insertion loss vs Frequency for Apltile SF5048 in the range 20 kHz to 200 kHz



Insertion loss measurements <25 kHz for SF5048 (50mm thick) tiles were conducted with samples mounted on a 5mm steel backing plate.
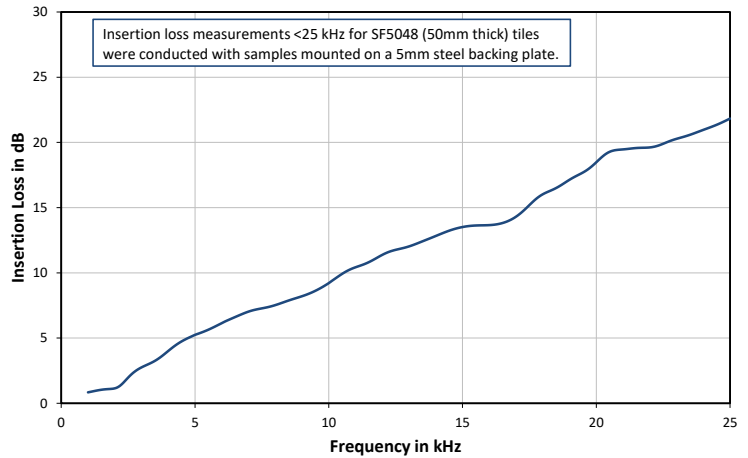
**Figure 2** – Insertion loss vs Frequency for Apltile SF5048 in the range 2 kHz to 25 kHz

$IL$ data relating to Apltile SF5048 has been provided by the National Physical Laboratory, London. Apltile SF5048 has been extensively calibrated and further data relating to its variation of performance as a function of temperature and hydrostatic pressure is available from Precision Acoustics Ltd on request.
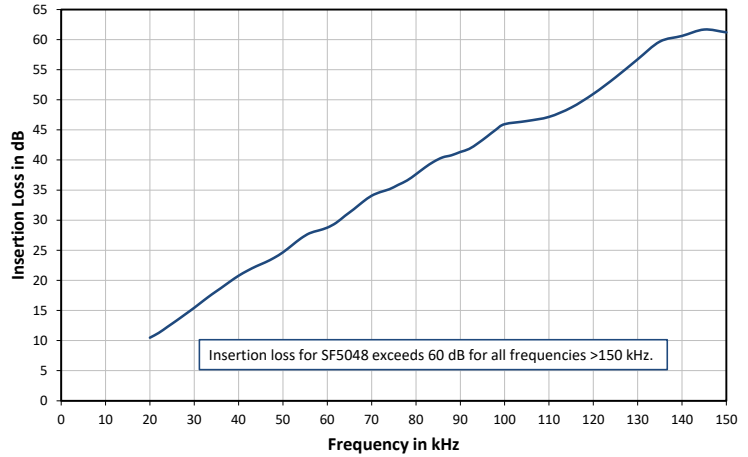
## ECHO REDUCTION

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.

Due to the frequency range of interest for Apltile SF5048 ER has been characterized in two experimental configurations:

1. As an unbacked tile over the range 20 kHz to 200 kHz as shown in Figure 3.
2. Mounted on a 5 mm steel backing plate over the range 2 kHz to 25 kHz as shown in Figure 4.

The dynamic range of these ER measurements is approximately 60 dB and values higher than this cannot be guaranteed.
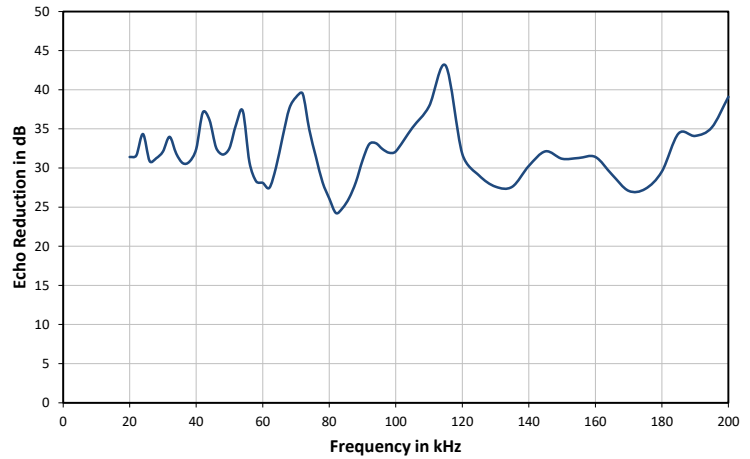
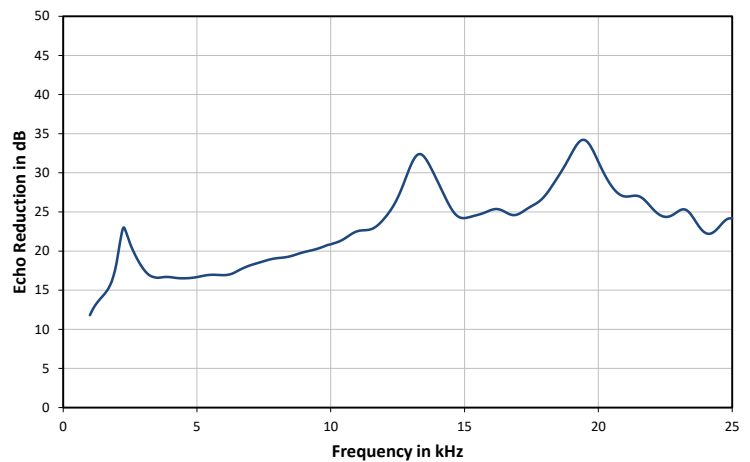**Figure 3** – Echo Reduction vs Frequency for Apltile SF5048 in the range 20 kHz to 200 kHz

**Figure 4** – Echo Reduction vs Frequency for Apltile SF5048 in the range 2 kHz to 25 kHz

ER data relating to Apltile SF5048 has been provided by the National Physical Laboratory, London. Apltile SF5048 has been extensively calibrated and further data relating to its variation of performance as a function of temperature and hydrostatic pressure is available from Precision Acoustics Ltd on request.

# FRACTIONAL POWER DISSIPATION

Fractional power dissipation (FPD) is defined as

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

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 Apltile SF5048 in two experimental configurations:

1. As an unbacked tile over the range 20 kHz to 200 kHz as shown in Figure 5.
2. Mounted on a 5 mm steel backing plate over the range 2 kHz to 50 kHz as shown in Figure 6.
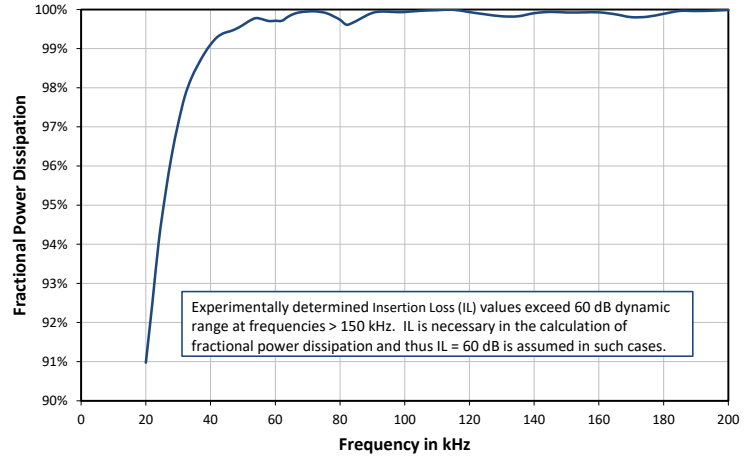


> Experimentally determined Insertion Loss (IL) values exceed 60 dB dynamic range at frequencies > 150 kHz. IL is necessary in the calculation of fractional power dissipation and thus IL = 60 dB is assumed in such cases.

**Figure 5** – Fraction power dissipation vs Frequency for Apltile SF5048 in the range 20 kHz to 200 kHz



> Both Echo Reduction (ER) and Insertion Loss (IL) measurements, which are required for the calculation of fractional power dissipation, were acquired with SF5048 (50mm thick) tiles mounted on a 5mm steel backing plate.
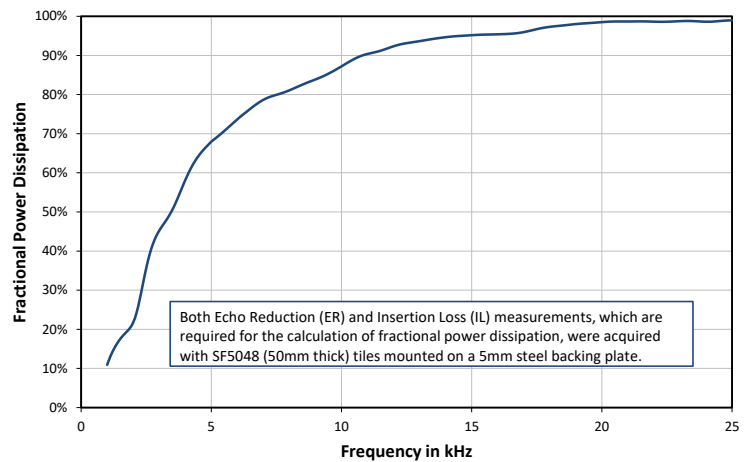
**Figure 6** – Fraction power dissipation vs Frequency for Apltile SF5048 in the range 2 kHz to 25 kHz

*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.*