PRECISION ACOUSTICS

AptFlex F13

AptFlex F13, from Acoustic Polymers Ltd is a two-component, flexible, high performance encapsulation material, exhibiting toughness, excellent hydrolytic stability and an acoustic wave speed and acoustic impedance similar to that of fresh water.

AptFlex F13, has excellent electrical insulation properties and can tolerate temperatures from -50 °C to +100 °C. It is particularly useful where small, delicate components are being potted since the material exhibits low shrinkage and hence stress during the cure phase and is transparent so that components can be visually inspected post-cure.

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

- Hydrophone potting
- Marine encapsulation
- Acoustic windows
- Cable gland strain relief

AptFlex F13 is part of a range of encapsulants and provides a good compromise between toughness, flexibility and minimisation of acoustic absorption. In addition, the cured product is transparent, which enables visual inspection of encapsulated units to trace potential defects found either during manufacture or in service.

TYPICAL PROPERTIES

Appearance	Natural (Transparent straw coloured)
Mix ratio (by mass)	4.0: 1 (A:B)
Shore A hardness	68 ± 3
Density	960 ± 20 kg / m^3
Density Part A	910 ± 20 kg / m^3
Density Part B	1220 ± 20 kg / m^3
Viscosity (Initial @ 25 °C)	30 Poise to 35 Poise
Average wave speed (1 MHz to 10 MHz)	1560 ± 20 m / s
Acoustic impedance	1.50 MRayls
Elongation at break	310%
Tensile strength	5.5 MPa

CURING TIMES

Pot life	20-30 minutes	
Gel time	50 minutes	
Cure time	@ 30 °C	7-10 days
	@ 60 °C	24 hours
	@ 80 °C	16 hours

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 two samples of AptFlex F13, and this is shown in Figure 1 and in Figure 2 for frequencies below 1 MHz.

The dynamic range of IL measurement is approximately 40 dB and insertion loss values higher than this value cannot be guaranteed.

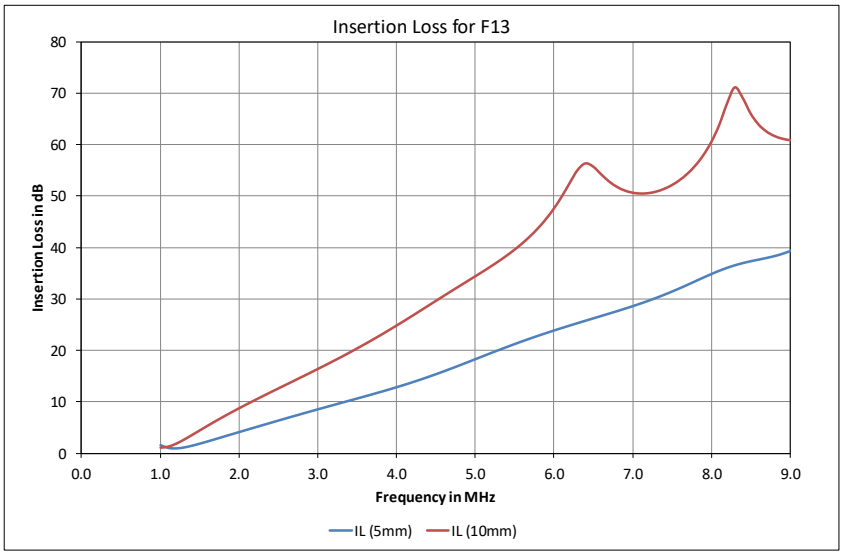

Figure 1 – Insertion loss vs Frequency for AptFlex F13

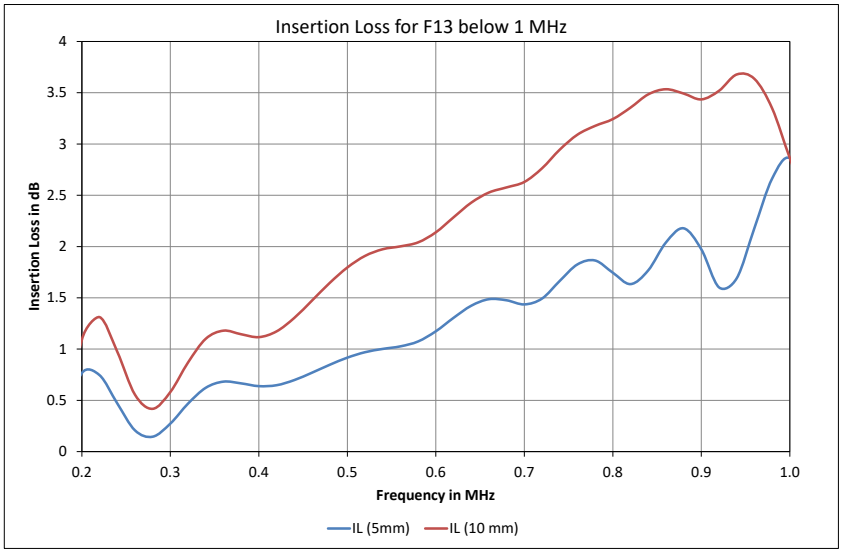

Figure 2 - Insertion loss vs Frequency for AptFlex F13 below 1 MHz

ATTENUATION

Attenuation (α) is evaluated from the measurement of Insertion Loss for 2 samples of the same material, but of different thicknesses. It is calculated as

$$\alpha = \frac{IL_1 - IL_2}{\Delta z}$$

where IL_1 is Insertion loss of sample 1, IL_2 is Insertion loss of sample 2 and Δz is the difference of between the thickness of the two samples. This has been experimentally determined for AptFlex F13, and this is shown in Figure 3 and in Figure 4 for frequencies below 1 MHz. The data is fitted over the entire frequency range 0.2 MHz to 5.0 MHz and displayed on an enlarged scale below 1 MHz.

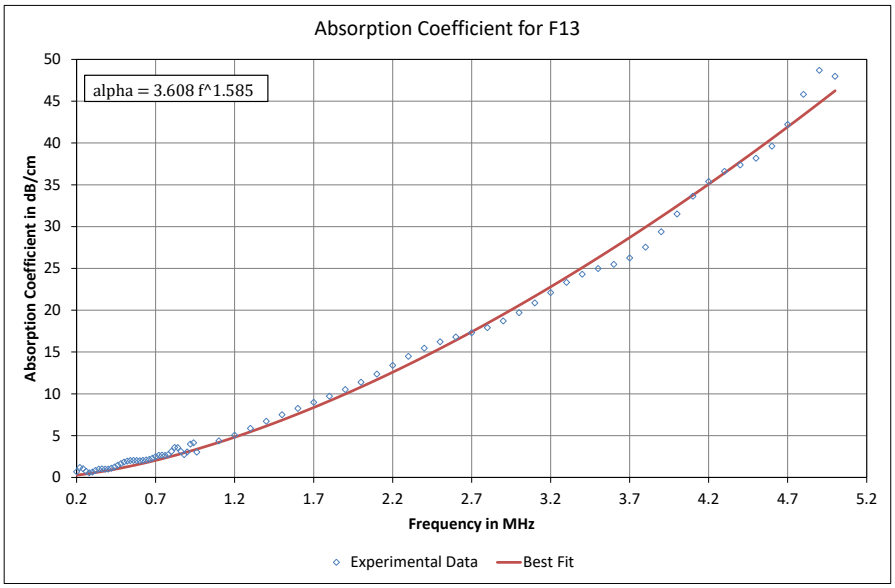

Figure 3 – Attenuation vs Frequency for AptFlex F13

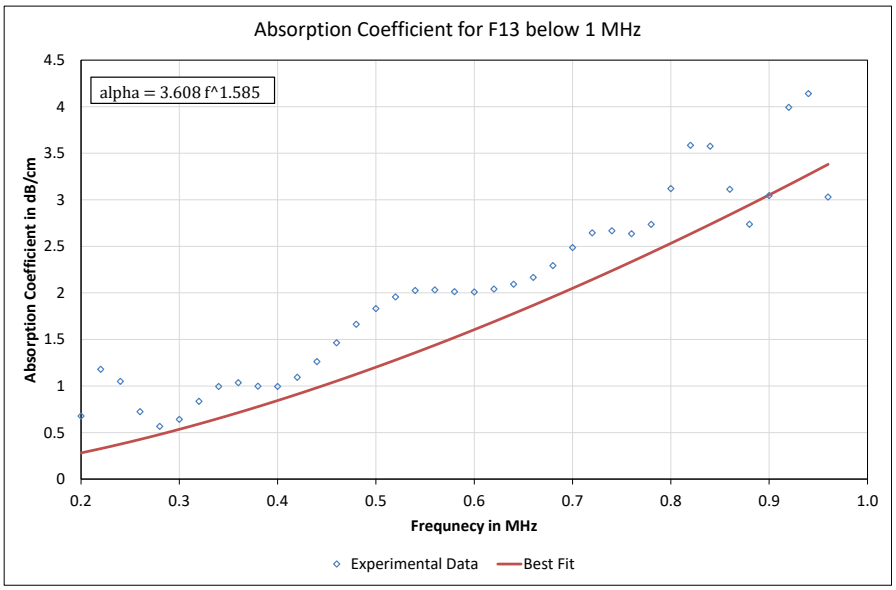

Figure 4 – Attenuation vs Frequency for AptFlex F13 below 1 MHz

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 F13, and this is shown in Figure 5.

The dynamic range of ER measurement is approximately 40 dB and values higher than this cannot be guaranteed.

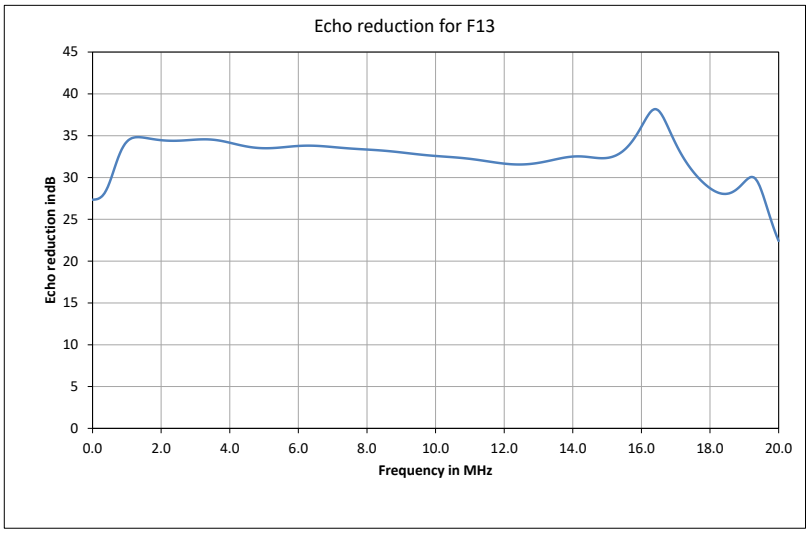

Figure 5 – Echo Reduction vs Frequency for AptFlex F13

PHASE VELOCITY

Phase velocity is evaluated from the measurement of transit time across 2 samples of the same material.

This has been experimentally determined for AptFlex F13, and this is shown in Figure 6.

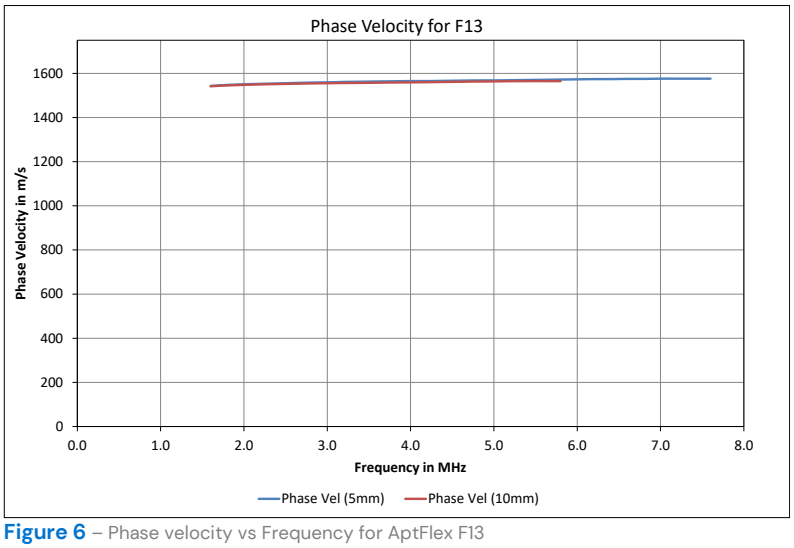

Figure 6 – Phase velocity vs Frequency for AptFlex F13