An Electromagnetic and Ultrasonic Shield

Greetings,

I like to present a Shielding Carpet for shielding Electromagnetic (EM) and Ultrasonic waves.

Shielding EM waves is easy. You need to enclose whatever you want to shield by some metal. Faraday cage is a good example.

But how are you going to stop Ultrasonics? Here is how. The acoustic impedance is defined as

$$Z = \rho v$$

where

ρ Material density (kg/m^3)

v Velocity of sound in that material (kg m^{-2}s^{-1})

So the impedance of air is

$$Z_{air} = \rho v = 1.2 \times 343 = 420$$

And the impedance of aluminum

$$Z_{alum} = \rho v = 2800 \times 5000 = 14000000$$

The reflection from an air-aluminum boundary

$$\Gamma = \frac{Z_{air} - Z_{alum}}{Z_{air} + Z_{alum}} = -0.9999$$

So the first boundary reflects most of the energy. Bubble wrap is placed to provide an air layer between two aluminum layers. Fig. 1 shows a practical implementation.

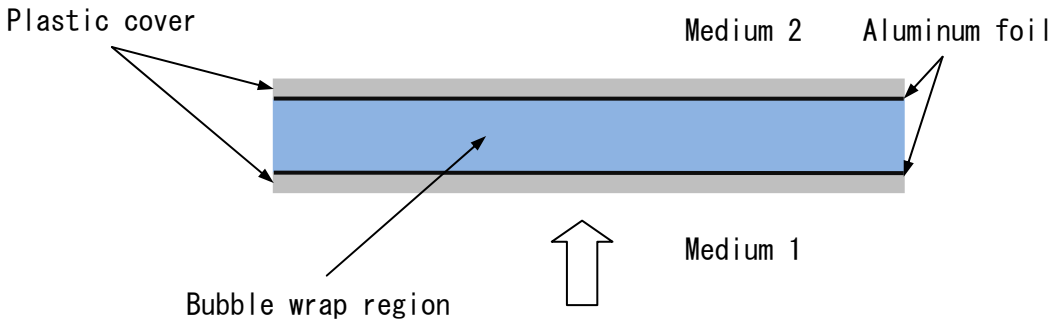

Fig. 1. Cross-section.

Fig. 2. Shielding carpet at my home.

Fig. 3. Close-up view of the layers.

Any questions or comments?

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