The Atlas Asimi Interconnect Cable

The Ideal Cable

In introducing the Asimi interconnect cable Atlas has tried to produce the closest approach to a theoretically perfect cable. In doing so it has gone back to the first principles of cable behaviour.

In most respects the ideal cable would be two un-insulated conductors floating in free air. They would be widely spaced and form straight lines to ensure that the capacitive and inductive components would be zero. The cable would then be no more than a simple resistor with no complex impedance components or frequency response variations.

The conductors should have a high degree of homogeneity to ensure that the speed of signal transmission is the same along the outside surface as along the inner core. This is because the high frequencies tend to travel along the outer surface; the so-called “skin effect”. In this respect such hybrid conductors as silver-plated copper wire often offer an initial exciting presentation however very soon deliver a tiring and irritating, unnatural sound. Silver plated conductors when exposed to moisture and Oxygen (during the manufacturing process) can create a galvanic cell where the copper erodes away over time, this is often called Red Plague.

The Conductors

The Atlas Asimi cable uses only the finest available conductors, specifically ultra-high purity silver wires which have been made by the "Ohno Continuous Casting" or OCC process. In this process the mould is heated to a temperature which is much higher than the melting point of the silver in order to prevent nucleation at the mould wall and to ensure axial directional solidification. The strands produced in this process are always single crystals with a very smooth surface and the granular structure is aligned in the longitudinal length of the wire rather than being aligned across the wire. Indeed there is less than one grain in about 125m of conductor so the audio signal travels through a continuous conductor instead of traversing repeated grain boundaries.

The Insulation

In order to avoid surface damage from corrosion as well as accidental short circuits the conductors are coated with a layer of insulation; usually a Thermoplastic material. But such insulation has a property of charge storage, commonly described as its dielectric constant figure. The cable forms a small capacitor with the two conductors being the plates of the capacitor and the insulation being the storage dielectric. So the presence of the insulation dielectric causes the cable to behave as a complex impedance rather than as a simple resistor; it reduces the transmission speed of the cable and can cause the cable to have an irregular frequency response when it is used with other equipment.

The dielectric constant or more correctly, the relative permittivity, of a material can be measured relative to the behaviour of a vacuum. By definition a vacuum has a dielectric constant of 1.0 whilst air has a figure of 1.00058. The common Polystyrene family of Thermoplastic insulators has figures ranging from

2.4 to 2.7 whilst the rubber insulation popular with some manufacturers of “exotic” cables, has a dielectric constant of 3.5 or more. The highest performance insulator in common use is polytetrafluoroethylene (PTFE). This material has a dielectric constant of 2.1 or more.

In an attempt to reduce the dielectric constant of the insulation for such cables as in low-loss co-axials for satellite receivers etc. a foamed polystyrene was developed where a significant proportion of the material is air in the form of micro-bubbles. By contrast Polytetrafluoroethylene is not a conventional thermoplastic; is not so easily processed and could not be “foamed” in the same way. However recently a new Microporous PTFE tape has been developed which has a dielectric constant of 1.4 or less. In fact a material whose performance is getting very close to that of free air as a result of the extremely porous PTFE tape being mostly composed of air.

Cables using Microporous PTFE tape as an insulator currently represent the "state of the art" in cable design; in fact cables which are very close to the "no insulator" ideal.

Propagation speed

Free electrons in any conductor vibrate randomly, but when a DC voltage is applied the electron’s motion will increase in speed proportional to the strength of the electrical field. However, when an AC voltage (such as a recorded music signal) is applied there is no real net movement at all; the electrons simply oscillate back and forth in response to the alternating electrical field.

Electromagnetic wave propagation is much faster and depends on the dielectric constant of the material. In a vacuum the wave travels at the speed of light and travels virtually as fast in free air. Propagation speed is determined by the dielectric constant of the insulation, so that in an unshielded copper conductor it can be around 96% of the speed of light, whilst in a typical polyethylene insulated coaxial cable it is in the region of 50% of the speed of light.

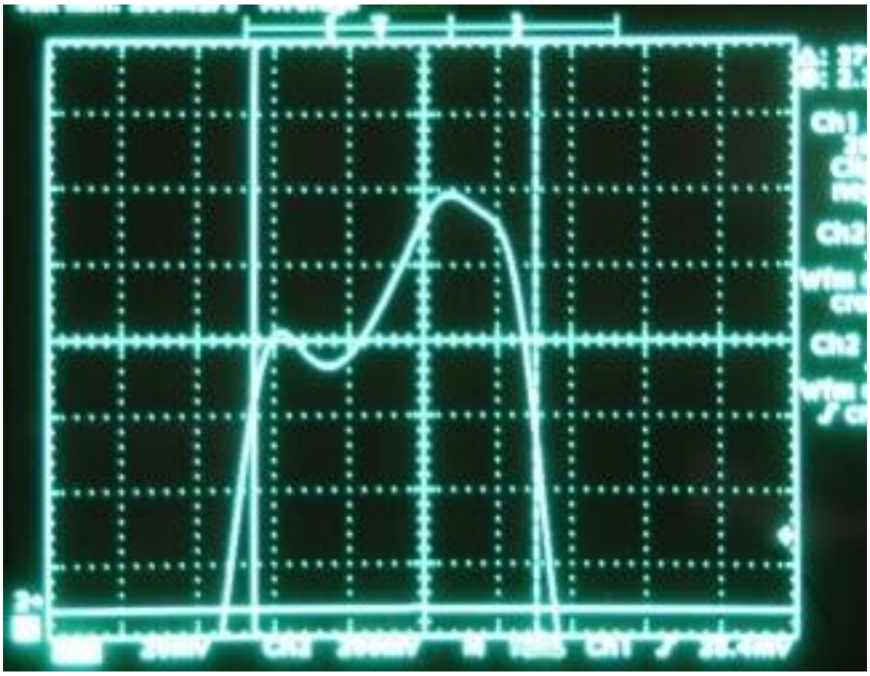
In the broadcast industry cables are often defined by their Velocity of Propagation (VOP) which is calculated using the equation: -

$$v = \frac{1}{\sqrt{\kappa}}$$

where κ is the dielectric constant of the material, so in a vacuum the VOP will equal 1. For comparison the VOP of a high-performance interconnect cable has been measured at around 0.7 and that of the Asimi interconnect at over 0.79, a figure which is well on the way to matching the performance of the theoretically free-air insulator.

Measuring the VOP

The Velocity Factor, and hence the VOP, of a cable is measured using a Time Domain Reflectometer which basically measures the time it takes for a pulse to travel down a cable to a matched load at its end and then be reflected back. This reflection can be seen on the screen as an initial pulse step followed by a larger pulse step as seen below in a measurement of an Atlas cable.



The calculation is made as follows. The time taken by the pulse is 16.9 nanoseconds to travel down a 2 metre cable and back so the pulse is travelling at 4.225 nS per metre. The speed of light is 0.2998 metres/nS so a signal in a vacuum travels a metre in 3.34 nSecs. Divide one by the other and this cable can be seen to have a Velocity of Propagation of 0.79.

The Manufacturing Process

This Microporous PTFE is extremely expensive and cannot be extruded onto a conductor in the normal way and therefore has needed to be carefully wrapped around the wires like a ribbon. Having no great structural strength great care needs to be taken during the construction of the cable to avoid the insulator being crushed when it would revert to being a piece of normal PTFE. To protect and maintain the cable geometry a secondary Polyethylene layer is extruded over the PTFE tape. This keeps the conductor central within the microporous PTFE layer.

The Screening;

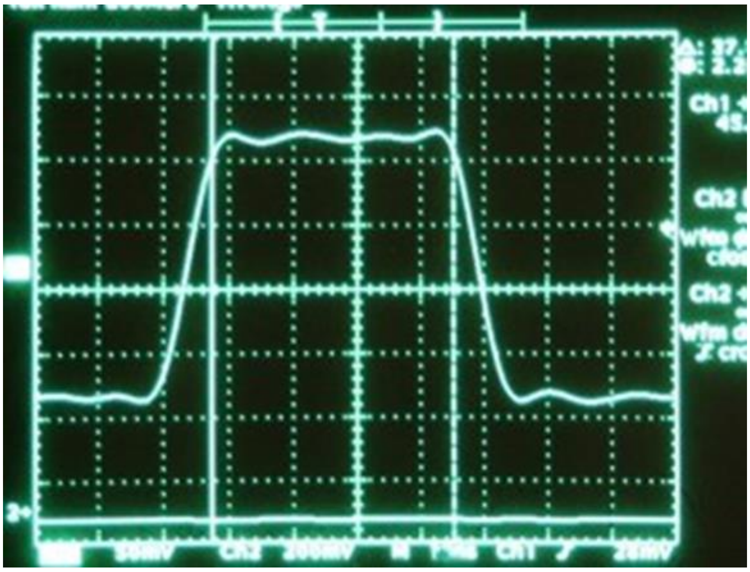
RFI (Radio Frequency Interference) is a major factor in cable design, especially now with the amount of ambient electrical wireless signals present in the majority of homes. To combat RFI, traditionally a metallic barrier (or braid) is encased around the insulated conductors and terminated at one or both ends. However, current manufacturing practice used to make the best termination possible involves the removing and twisting of the braid, introducing mechanical screen distortion and thereby delivering an inconsistent RF performance.

For the new Asimi, Atlas developed a new system that uses two symmetrical drain wires (each attached to 180 degree segments of the plug) inserted between a 100% copper Mylar foil and SPC screen.

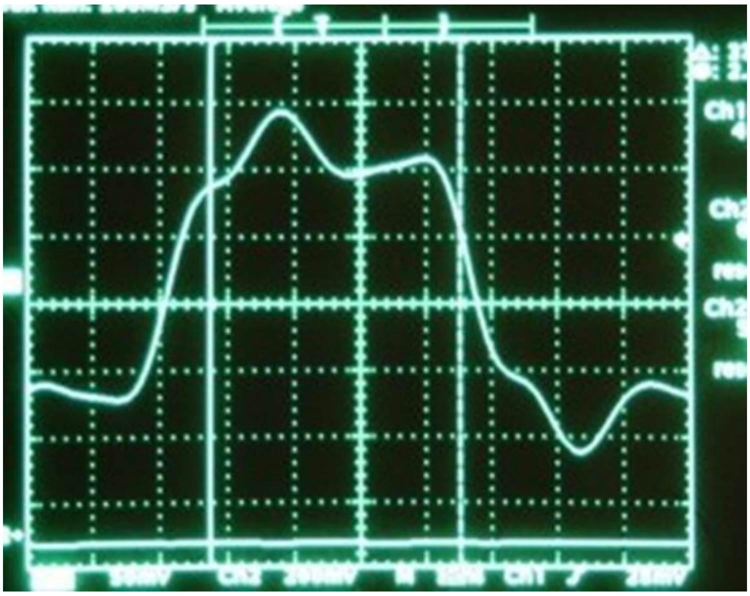
This unique dual drain system connects the screen effectively to the cable return plug interface and provides total 360° screening, whilst not distorting the integrity of the screen in any way!

Summary:

Ultimately the listener will make his or her own judgement of the success Atlas have achieved with the Asimi interconnect cable. Our extensive work has shown the Asimi to be an exceptional conductor of electrical signals with a smooth and extended frequency response as can be seen from the comparison of the two signals below which show the transmission of high frequency signals. The output from the Asimi cable is a near perfect replica of the input pulse whilst the output of the other cable (popular) can be seen to be heavily distorted due to it having a unregulated complex impedance which caused different frequencies to get out of step with each other.



Atlas Asimi



An alternative interconnect cable

With the Asimi, Atlas has engineered an outstanding wideband audio cable which has made a major and measurable step closer to the theoretical ideal of the perfect cable. This has required a dramatic improvement in cable technology and manufacturing methods, and we feel that every listener will hear the benefits every time they listen to their music. C.2023