LASERWIRE SOLUTIONS

Application Note **LWS-AN 2018 / 05**

Micro-Coax Stripping

Introduction

Micro-coax cables are made up of a metallic conductor with a dielectric insulation which in turn is covered by a braided shield and a polymer jacket.

There is no clear distinction of what size constitutes a micro-coax, as opposed to an ordinary coaxial cable, but certainly once the conductor gets below 30 AWG, the cable presents difficulties in stripping.

Micro-coax cables can be used singly, within a larger cable assembly or ribbonized. Ribbonizing micro-coax cables is a popular design feature, as once stripped, the fixed pitch enables more convenient soldering to a connector or PCB.

Micro-coax is found in a wide variety of applications from mobile phones and laptops to medical devices, such as ultra-sound systems or RF ablation catheters.

Mechanical Stripping versus Laser Stripping

Single micro-coax down to 38 AWG can be stripped by sophisticated semi-automatic mechanical wire strippers, such as the Schleuniger CoaxStrip 5300. Rotating blades are precisely set to cut into the various depths of the cable to cut each layer sequentially.

Figure 1: 50 AWG micro-coax – laser stripped

However, smaller gage wires can only successfully be stripped by laser. Laser stripping is regularly used to strip coax as small as 50 AWG. Ribbonized micro-coax also cannot be stripped mechanically, laser stripping is the only viable solution – no matter the gage!

Figure 2: 42 AWG micro-coax ribbon – laser stripped

The Laser Stripping Process

Laser stripping of micro-coax (either single wire or ribbon) is a multistep process. Due to the differing physical properties of polymer jacket / dielectric compared to the metallic shield, it is necessary to use 2 distinct laser technologies. Carbon dioxide laser technology is used for the jackets and dielectrics and fiber laser technology for the shields.

The Mercury CO_2 laser technology is a long laser wavelength being strongly absorbed by the polymer and reflecting from the shield and conductor.

When it comes to cutting the shield – there are two main options:

- **Soldered Scribing**: the shield is solder dipped and then lightly scored (scribed) by a shorter wavelength laser, such as the Gemini series of lasers. This creates a stress line in the shield which allows it to be snapped easily – thus removing the shield as a solid piece.
- **Solderless Scribing**: if the dielectric material does not absorb the scribing laser wavelength, it is possible to directly cut the shield without the soldering step.

Soldered Scribing

This is the standard method for laser-cutting micro-coax cable. It is generally applicable for most cable types. The process requires that the shield is solder dipped. Often this is a required process anyway as the shield has to be connected to the PCB ground plane. When solder dipping, it is vital that the heat of the solder dipping does not damage the dielectric, such as melting it to the shield. For this reason, a low temperature melt solder is often used – such as bismuth-based solder alloys.

The process is as follows:

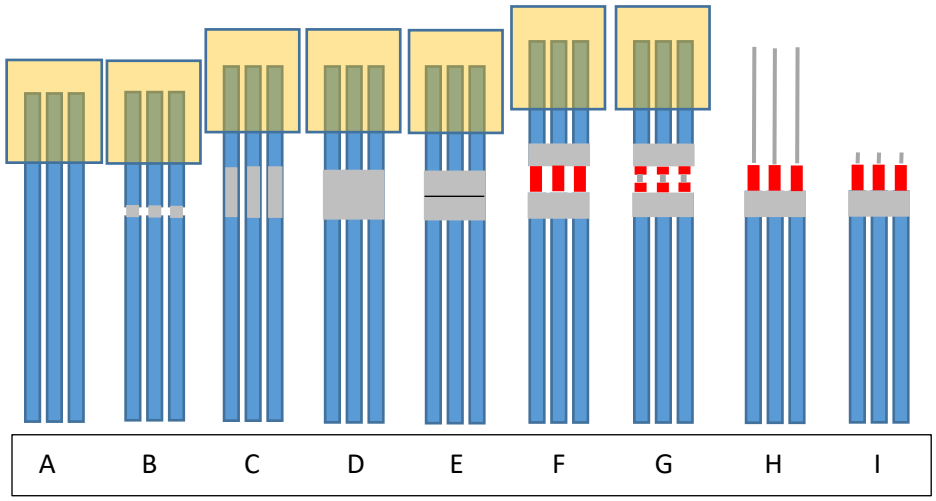

Figure 3: Laser Stripping Process with Soldered Scribing

A – tape is applied to the end of the cable – a layer of tape is applied on the top and bottom with the adhesive sides facing each other. This gives a gripping surface – as gripping the cable

jacket compresses the layers and prevents slug removal. The cables are held in a fixture which grips the body of the cable without damaging it.

B – a Mercury laser system cuts a line in the jacket, reflecting from the shield. Either a Mercury-2 or Mercury-4 can be used depending on the number of cables to be stripped simultaneously.

C – the jacket slug is pulled back to reveal the shields (note the slug remains on to maintain the cable pitch.

D – the cable end is dipped in solder to form a single solder mass. It is important that the solder layer is uniform. The tape must withstand the solder dip – or pulled away before this stage.

E – the shield is scribed with a laser – either a Gemini-2 or Gemini-4 depending on the number of cables. The cut is around 50% of the soldered shield thickness.

F – the shield is flexed at the scribe line – the cable being supported on either side of the scribe line. The shield snaps, shearing the whole of the shield to give a 360-degree cut. The slug is pulled back to expose the dielectrics.

G – the Mercury laser makes a strip to cut the dielectric. The laser reflects from the conductors.

H – the dielectric slugs are pulled off.

I – the conductors are cut to length.

Note that the cables remain in the fixture at all times to give a dimensional reference. High accuracy strip lengths can then be achieved <0.1 mm tolerance.

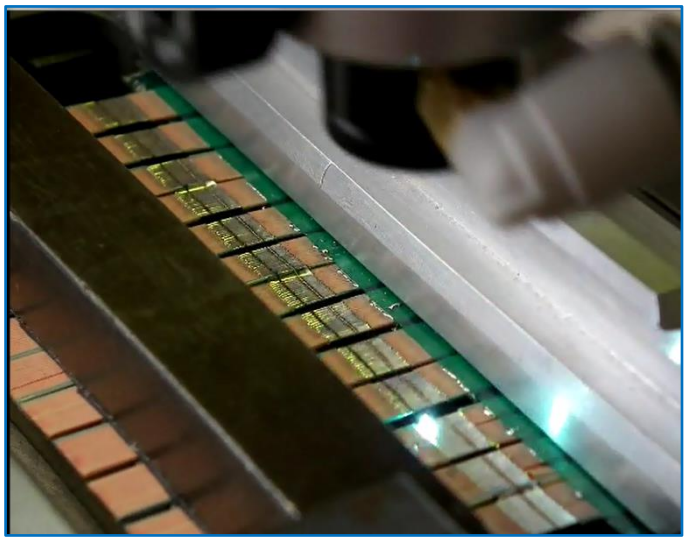

Figure 4: Micro-coax ribbons in the process of being laser scribed on a Gemini-2

Solderless Scribing

An alternative process is to directly laser cut the shield without the soldering step. In this case a different laser is used to completely cut through the shield strands. The laser light reflects from the dielectric. This method relies on the dielectric being reflective to the laser wavelength. A short wavelength is used for this reason – but the best results are achieved for light colored insulations – especially white. Black insulations absorb the laser light and hence are not suitable.

In this instance, the Odyssey-7 system is used to cut the shield. The product is available as a standalone unit or packaged with a Mercury unit to provide a single box solution. Email us for more information on the Odyssey-7 and the complete package.

One advantage of eliminating the soldering process, is that it is easier to automate the process without the need for messy soldering steps. We offer customizable fully automated lines and stand-alone systems for the preparation of micro-coax singles and ribbons.

The Complete Solution

We are able to offer the full solution including laser stripping / scribing equipment, fixturing as well as solder station and slug pull / bend & break tooling.

The challenge is as much a materials one as it is laser – and we can advise you on the cable design and selection of materials to achieve the best results.