PL-259 Connectors Revisited

by
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Overview

Most would think that there cannot be much left to say about the PL-259 / UHF connector any more. However, I think there are some important considerations regarding this connector that may be of interest.

"On the Bench". TCA. March April 2007, has spoken of the difficulty of soldering the coax braid to the connector shell, that being, how to heat the connector and braid without melting the dielectric, and at the same time, assuring that the braid actually soldered to the connector. The four small diameter holes at the neck do not provide adequate means to solder or inspect. Many of the problems experienced over the years at this station, and others, can be attributed to poorly or improperly soldered connector - braid interfaces.

What Problems?

If the braid is simply making mechanical contact to the connector, that is, an uncertain electrical connection, consider the following,

Conductivity. It is imperative that the coax braid be electrically bonded to the connector. Visually, the connector may appear OK because the holes are filled with solder, but most often, because heat did not transfer well from the connector to the braid, a soldered connection to the braid does not exist. This leads to an electrical intermittent or open circuit.

Mechanical. If the braid is not well soldered to the connector, and the connector is supporting a length of coax, such as the feeder to a dipole antenna, the considerable weight of the coax is taken by the center pin and the outside jacket of the coax that is threaded into the connector. This is not mechanically sufficient. A strong mechanical connection to the braid around the internal perimeter of the connector is imperative to reliably support the weight of the coax.

Shielding. If the electrical connectivity of the braid is marginal, that is, by a few stands of the braid, the coax is electrically "open" from a shielding perspective, and will allow the ingress of unwanted signal. Unwanted signal currents are induced on the outer surface of the braid and will flow to the inside of the coax where the desired signal from the antenna exists. This permits broadband signal to "enter" and load the front end of the receiver. Don't believe it? Undo the antenna coax from the rig and pull out the PL-259 such that the center pin still makes contact but the connector shell does not. It will sound a whole lot noisier than with your antenna. If it does not sound noisier, you probably have an open braid somewhere at a connector.

All of the above may not always be revealed as a high SWR but as a changeable SWR.

Making the Right Connection

To make the connector to braid solder connection, two criteria must be met. The tip of the iron must contact and heat the braid simultaneously with the heating of the connector, and secondly, the solder joint must be confirmed visually to see that the braid has soldered to the connector. This can't be done well given the small diameter holes. These problems can be resolved.

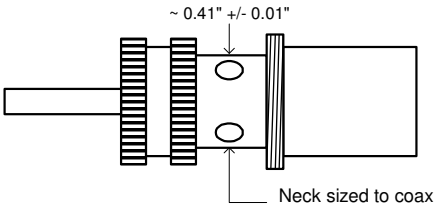
Start with a good quality PL-259. Refer to Figure 1. It can be seen that the diameter of the connector "neck", where the braid is to be soldered, can vary. The neck must be of a dimension that is snug to the braid of the coax being used to achieve heat transfer when soldering. The connector with the narrow neck is to be used for 50 ohm, RG213, 9913, LMR400 style cable. If

the wide bodied connector is used, it will be impossible to solder to the braid due to the gap between the body and the braid. Use silver plated connectors as they will take solder very well. In this example, the wide bodied connector had a nickel or chrome finish. This is not uncommon and these finishes do not take solder at all well and ought not to be used. Another requirement is to ensure that the center insulator be Teflon as it takes heat well compared to other insulation materials that may melt completely or soften, and misalign the center pin.

Wide Neck

Narrow Neck

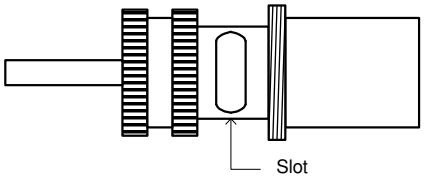
Figure 1



Narrow Neck PL-259

Figure 2

To achieve the required connection, it will be necessary to modify the connector using a Dremel© tool with a small cutting wheel or a razor saw such as available at hobby shops. Cut a slot between any two side by side holes. The width of the slot is the same as the width of the holes at each end of the slot. See Figure 3. This slot now provides the required access to solder the braid and to inspect the joint.



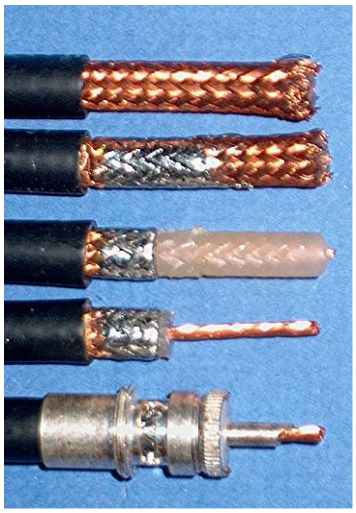
Slotted PL-259

Figure 3

The Procedure

Having prepared the connector, follow Frank's "On the Bench", TCA April / May 2007, procedure through step 7, noting that the tinning of the braid in step 3 is critical. Figure 4 provides an illustrated summary of these steps.

Figure 5 illustrates the progressive cable end preparation as per "On the Bench".



Cut cable outer jacket back ~ 1-1/2" exposing braid

From jacket, tin braid ~ 3/4" outwards, all around

Using a metal pipe cutter *, trim braid to ~ 7/16"

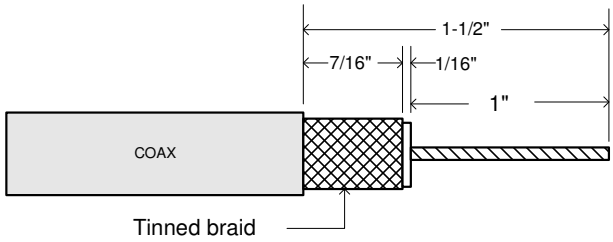
* Refer to Sidebar for Pipe Cutter

Cut & remove dielectric leaving ~ 1/16" beyond braid

Screw PL-259 onto cable. Ensure braid fills slot

Figure 4

The prepared cable end is dimensioned per Figure 5.



Coax Cable Preparation

Figure 5

Replace steps 8 and 9 in "On the Bench" as follows,

Step 8. As the prepared cable is screwed into the connector, the tinned braid will come past the slot. Wind the coax fully into the connector so that the tinned braid fills the entire slot. The braid should be against the slot. If it is not close, the connector and coax may not be correctly sized for each other and heat will not bridge the gap, and will not make the solder connection.

Step 9. With a soldering iron of at least 100 watts, or a gun of at least 140 watts, insert the tip of the iron into the slot to get heat onto both the braid and the connector shell at the same time. Wet the iron - joint contact surfaces with a little solder to improve the transfer of heat from the iron to the work. When the temperature is right, the solder will flow equally well on both the braid and connector. Add solder as needed. Evidence of a soldered connection will be a visual impression of the braid pattern in the solder, the solder having flowed smoothly on both the connector and

braid. One can easily confirm that the coax braid is soldered to the connector. Finish the connection by soldering the remaining two holes while the braid and connector are still hot. Poke the tip of the iron into the hole, feed solder into the hole, and watch for the solder to wick down onto the braid.

Complete steps 10, 11, 12.

Test It

The finished connection must minimum be tested for continuity as a minimum - center pin to center pin and shell to shell, and no shorts. You can also verify the cable for shielding. Tune your transceiver to an active band with strong signals being heard. Remove the antenna coax from the rig and connect the new coax cable to the transceiver. The other end of the coax needs to be connected to a dummy load such as a cantenna. If you do not have a dummy load, make one. Use a SO-239 female chassis connector and solder a 51 ohm ¼ W resistor, carbon or metal film, from the center pin to the flange. Tolerance and wattage are not important as long as this is used as a receive termination. Do not hit the PTT as the resistor will vaporize.

If the connector is properly installed, the band will be quite dead because the cable is completely shielded and cannot pick up signal. Wiggle the cable at both connectors. If signals suddenly jump up, the connection to the braid is intermittent and so the job is no good.

Note that the quality of the coax will have an effect on the degree of shielding effectiveness. Less expensive coax with 70% braid coverage will leak RF noticeably whereas > 90% coverage will be much improved, and braid with 100% foil will be excellent. Use the best you can afford in this respect.

Connectors can pass continuity and fail shielding. The DC continuity may measure OK only because a few individual braid strands are connected, either electrically or mechanically. Even SWR may look OK. However, this does not make for a reliable, stable, effective, or RF shielded joint and so the coax becomes RF leaky, on both transmit and receive. This situation is to be avoided.

Be Confident

Considering the amount of time I have wasted looking for faulty connections, intermittencies, leaking RF and unstable SWR's, this procedure makes the connection all at once permanent and reliable.

Acknowledgements

A long time ago, a commercially manufactured PL-259 with such a slot turned up in my junk box. I had no idea why this connector had such a defect and so I paid no attention to it. Many years later, Lee Sawkins, VE7CC and I were discussing connectors at a BCDX meeting and he mentioned the slot and how it makes all the difference in terms of making a verifiable connection. I paid attention this time and have used that method ever since. Thanks Lee.

SIDEBAR

MAKING a CLEAN CUT

After the braid has been tinned and cooled, use a small pipe cutter to "ring" the stiffened braid. Increase the depth of the cut to slice into the dielectric. Do not cut the center conductor. Remove

the pipe cutter and carefully finish cutting the dielectric down to the center conductor with an Exacto knife, again being very careful not to nick the conductor.

If the center conductor is stranded, the individual conductors will have a twist. The dielectric - braided end has to be pulled off with a twisting motion in the same direction as the twist. Pulling it straight off doesn't work unless the center conductor is a solid, single wire.

I use the pipe cutter illustrated here, a Rigid model 104, 5 to 24 mm range. Any similar one will do.