

## Cutting precise coax lengths -- a solution

The need for identical lengths of coax arises whenever you need to feed two identical antennas together, or make a coaxial balun or a phasing network for a directional array or for circular polarization. Usually you need a precise number of electrical half-wavelengths or quarter-wavelengths. The physical lengths of cable required can be anything from say 53m (an electrical half-wavelength on Top Band) down to 40mm, an electrical quarter-wave for 1.3Ghz. Whatever the wavelength, the obvious answer - "use a ruler" - doesn't always work. Even if you know the velocity factor of the cable in question, it's often difficult to measure an accurate length, especially if your steel tape is as flexible as the cable itself. Moreover the velocity factor of the cable may well vary slightly from the catalogue value, so the whole is not quite as straightforward as it seems.

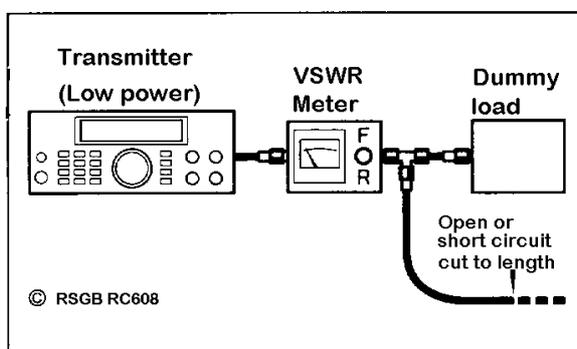


Fig.1: Simple technique for cutting coaxial cable to a precise multiple of an electrical half or quarter-wavelength. Trim the end of the cable to show minimum VSWR

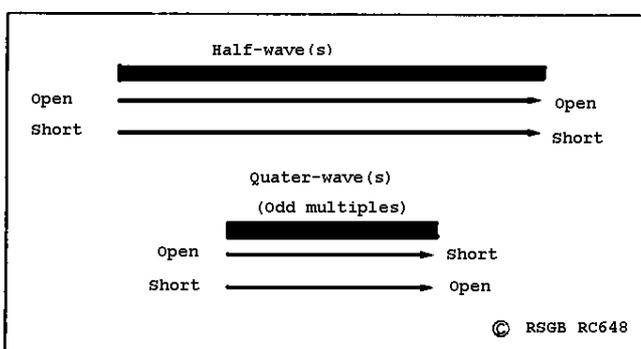


Fig.2 (a) An electrical half-wave (or any multiple) shows the same impedance at its far end. (b) An electrical quarter-wave (or any odd multiple) shows the 'opposite' impedance at its far end.

The method that G3PJT described has been published before in many places, with some variations according to the frequency involved. It allows you to cut coaxial cable to a precise number of electrical half or quarter-wavelengths, regardless of the physical length involved. For a long length do not even need to uncoil the roll.

Begin by putting a plug on one end. Then connect the cable to a T-adaptor between the VSWR meter and a dummy load (Fig.1). The VSWR meter is fed from your transmitter, at sufficiently low power that strange load impedances will not damage the transmitter. One or two watts are usually plenty. Without the cable connected at the T, the VSWR meter sees the matched dummy load, so the indicated VSWR should be very low. If you connect a random length of cable at the T, its reactance appears in shunt across the dummy load and the VSWR will rise. The exception is when the shunt reactance at the end of the cable is very high, almost as high as if the cable were unplugged. This only happens in two circumstances: when the cable is an exact electrical half-wave long and open-circuited at the far end; or when it is an exact electrical quarter-wave long and shorted at the far end. The situation repeats itself every half-wavelength with the open-circuited cable, and for odd numbers of quarter-wavelengths with shorted cable (Fig.2).

Let's take the half-wave example first. All you have to do is plug in an over-length cable, and snip short lengths off the open-circuited end until the 'reflected' reading on the VSWR meter falls back to zero. There you have an exact electrical half-wavelength.

Let's look at the quarter-wave case next. You have to short-circuit the cable, which is not as easy as just snipping an open-circuited end. Rather than strip and twist the inner and outer conductors together each time you cut the cable, a quick way to explore is to short the cable by pushing in a large, sharp pin (an old-fashioned hatpin is ideal). If you are careful, this will not significantly damage the cable, so long as you remember to waterproof any extra pinpricks that you made beyond the final cut. The pin will not provide very accurate short-circuit at VHF/UHF, so you'll still need to strip the cable for the last few cuts to find the exact length. With these techniques and a little patience you can easily cut a cable to within 1% of the nearest electrical quarter-wavelength, regardless of the overall electrical length of the cable. If you need something different from exact quarter or half-wave, calculate the frequency at which the length you need is resonant in either of those two modes, and carry on from there.

The accuracy of these techniques will depend on your dummy load and VSWR meter, but generally it will be very good indeed. I mentioned earlier that the exact length of the cable may not matter. The reason for this is that when you're cutting two or more cables to the same length for use in a phasing harness, it's much more important for all the lengths to be identical than to be accurately resonant. When you fit connectors to the cut ends, just take care to treat each cable the same. Use a ruler to measure how much you strip off the outer and inner conductors (instead of 'eyeballing' it like you usually do) and you'll finish up with very accurately matched set of cables. When measuring-up to fit the plug, you may also be able to compensate for having to cut one cable a little too short.

In a feature article I will describe a modification to your VSWR meter so that your VSWR meter can read a much deeper dips than it can do at the moment -- Viv - ZR6 UZ.

## **ACKNOWLEDGEMENT TO**

1. Ian White, G3SEK. In Practice, Radio Communication, July 1995.