The Bodger's Guide to ……..

Recycling a Mini Circuits ZAPD1 0.5-1GHz power splitter.

Introduction

This article describes how to make a low power 2 –way 6dB resistive splitter covering DC to over 4GHz using (an otherwise useless for Amateur Radio) 0.5 to 1GHz splitter. The finished splitter can be used as a receiver splitter or as a general purpose splitter for network anayser use.

Recently there have been LOADS of mini circuits ZAPD-1 power splitters available for sale at rallies and round tables for £5 or less. They are resonant hybrid 0 degree splitters covering 0.5 to 1GHz. They look like Figure 1 below.

Figure 1 - The Mini circuits ZAPD-1

The datasheet can be downloaded at http://www.minicircuits.com/pdfs/ZAPD-1.pdf Sadly they don't work very well either at 70cms or 23cms as they stand, the isolation, return loss and power phase split are poor. Over here in Europe we don't have a 900MHz band so if you buy these you have two choices.

1. Use them as a paperweight
2. Use the box and connectors to build something useful.

So what can a Bodger do with them?

Opening them up and you'll se inside some sort of wideband dual Wilkinson splitter (see Figure 2)

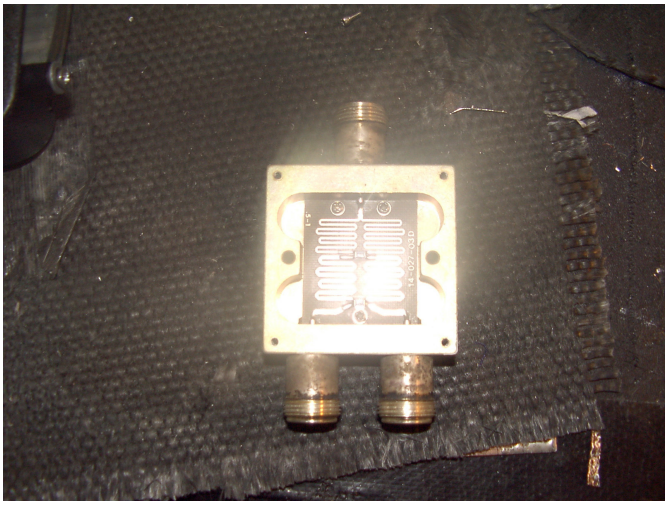

Figure 2 - Unmodified splitter

Like the 900MHz power hybrids described in Bodger's guide #3 you can use the PCB material and box to make a resistive splitter using a "delta" of three resistors and my old pal, adhesive copper tape.

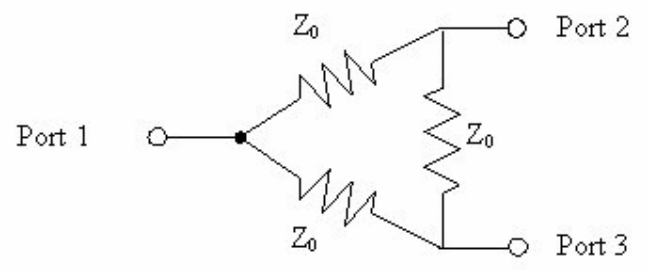

Figure 3 Delta or Wye resistive splitter

This consists of three 51 ohm 0805 SMD resistors arranged as in Figure 3. You can learn how these work from the excellent Microwaves101 Website,

http://www.microwaves101.com/encyclopedia/Resistive_splitters.cfm

from where Figure 3 was taken.

The first stage is to either peel off the unwanted tracks or use a PCB resist pen, cover the pieces you want to retain as per Figure 4 and etch the tracks away. Unlike the 900MHz power hybrids, these tracks peel easily with care and a fine scalpel. If you do decide to etch, **MAKE SURE you also tape over the reverse side ground plane with parcel tape, as solder tinning does NOT resist Ferric Chloride etchant!**

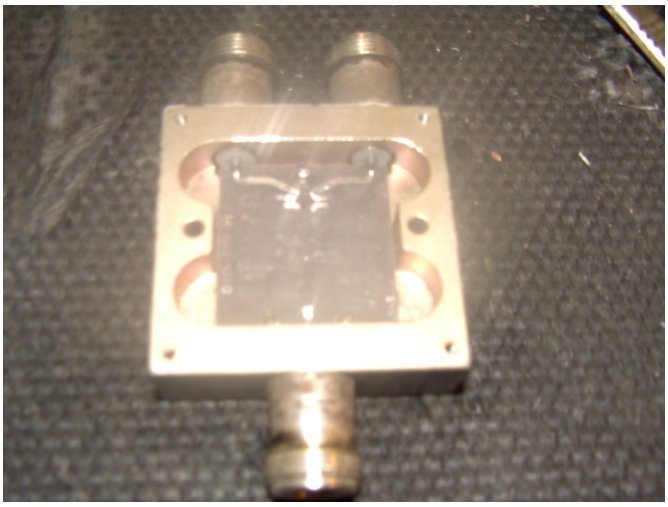

Figure 4 Coupler with unwanted parts removed

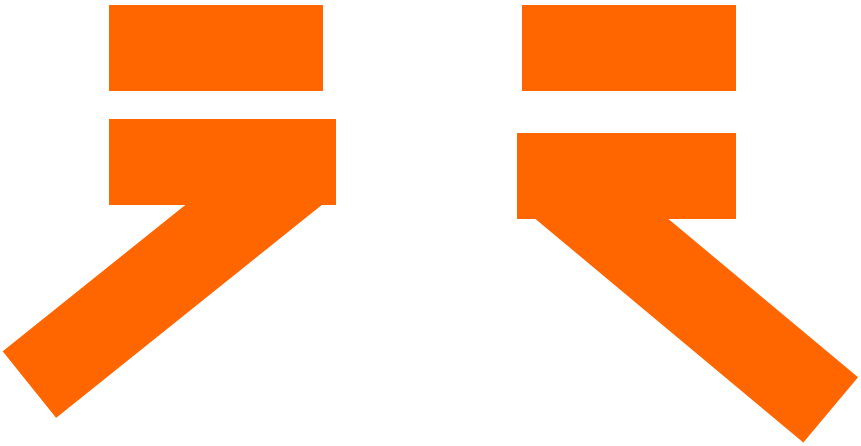

Figure 5 Close up of remaining tracks at split ports

Once etched or peeled, you are left with just the connecting tabs to the three ports, and a pair of tracks to allow you to fit the SMD resistors as in Figure 7.

Next, add a long 50 ohm track from port 1 (S) of the delta as per Figure 6. Note that the track width needs to be measured very accurately using vernier callipers and cut and placed very carefully.

The width of this track should be the same as those to the existing to ports 1 and 2. i.e about 1.9mm.

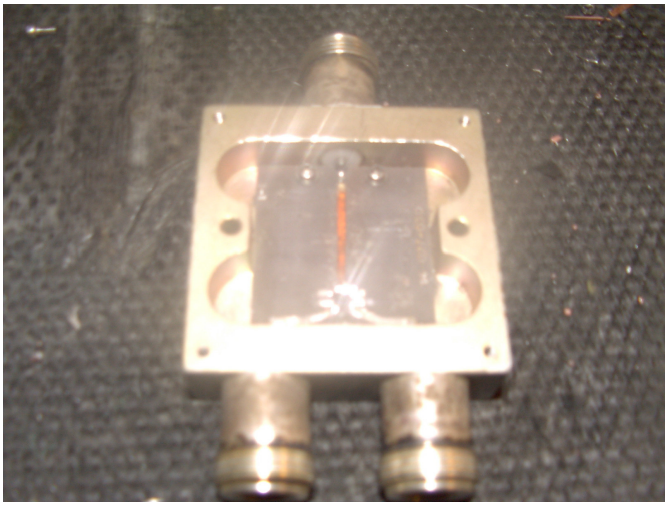

Figure 6 Finished PCB

Now you can fit the three resistors to the tracks as per Figure 7 below.

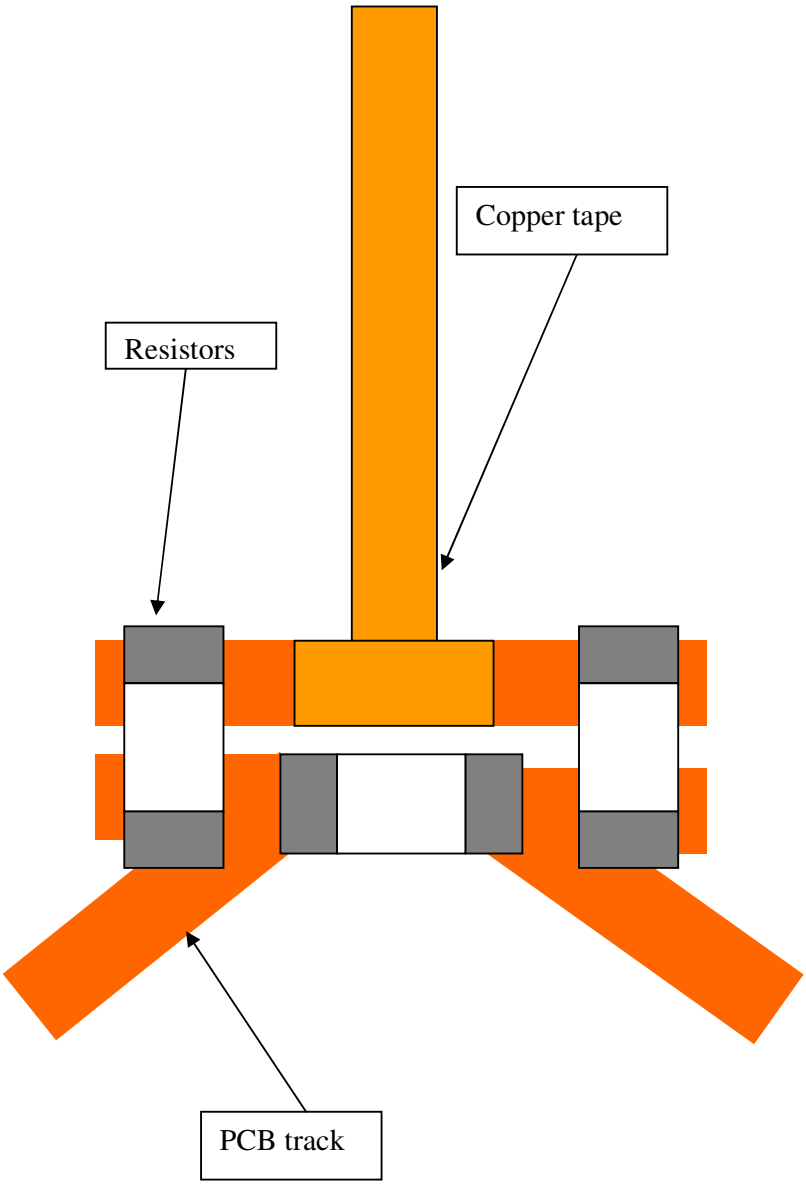

Figure 7 - Final splitter layout

Test results on finished splitter

The Phase match of this 0 degree 6 dB Splitter over DC to 1300MHz was better than 1 degree. I could not measure phase above 1300MHz but insertion loss and return loss up to 4GHz are shown in Figure 8 and Figure 9 below. The return loss depends very much on how accurately you cut the width of the port S stripline.

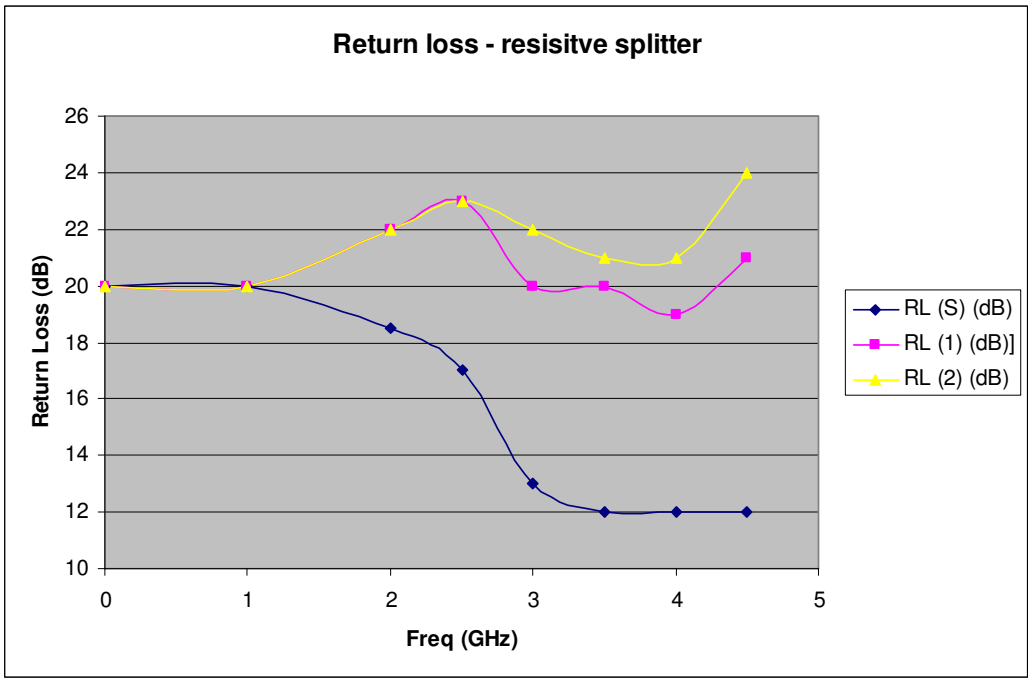

Figure 8 Return loss

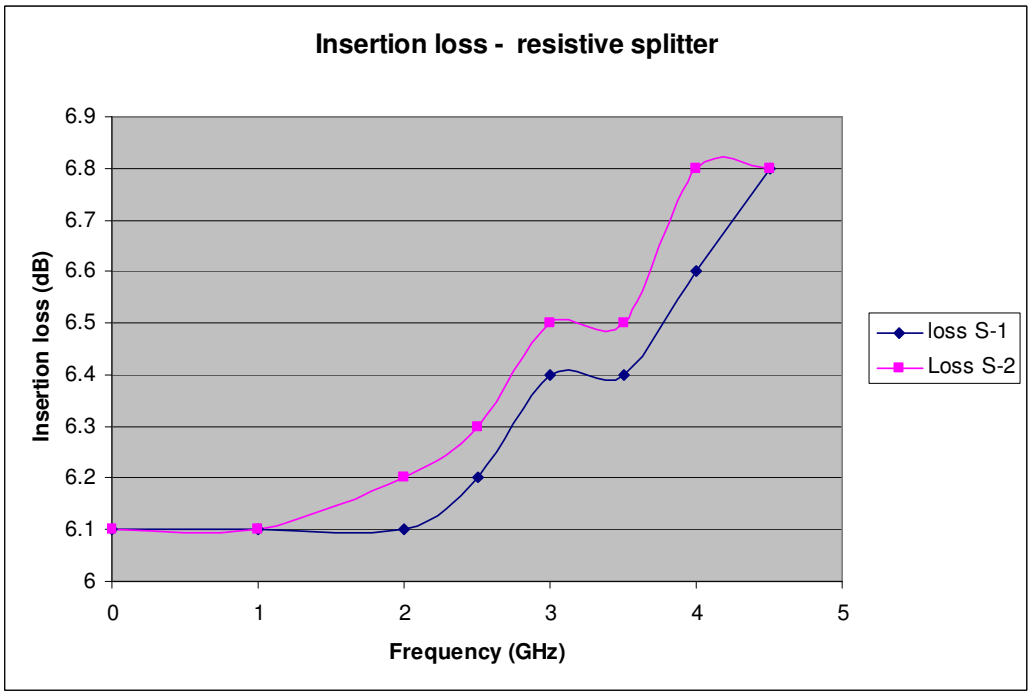

Figure 9 Insertion loss