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The simple man's Spectrum Analyser Construction Techniques

{gallery}saconstruction/1{/gallery}

There are many ways of constructing this project. It is essential to use good RF screening between modules to reduce spurious responses. Good coaxial connections between the modules are also vital. The type of coaxial connectors used isn't that crucial. Since VHF frequencies are involved it's very important to keep all lead lengths as short as possible.

Modular Construction

I find a modular construction style very useful, and particularly applicable to this project. Each module can be tested individually, and a working analyser can be arranged by connecting together some of the modules before all are complete. Being able to connect the modules in different ways helps with testing.

{gallery}saconstruction/2{/gallery}

In the spectrum analyser, modular division of the circuit naturally creates a separate module for each RF section, which can be built, tested and made RF-tight in isolation. I built each RF circuit into it's own shielded box, made from PCB stock. I love this method of construction. PCB is

Spectrum analyser construction techniques

Written by Hans Summers

Tuesday, 08 September 2009 23:32 -

easy to cut, easy to solder, and you can create nice boxes of exactly the size and shape required.

The module bases are sized a little larger than the box, so that there is a strip of PCB protruding at each end which can be soldered to the base board (see later). A small square of PCB soldered in each corner is drilled with a 1mm hole for screwing on the lid. Small quarter-inch size 4 screws are perfect for the job. I soldered strips of brass shim (available from model shops) over the box edges so that the PCB box lids make good electrical connections with the box walls. It was amazing to observe the reduction in spurious responses and the lower noise floor, as the modules were boxed up instead of being on open boards.

No PCB's!

I never use PCB's in my projects. Partly this is because I think the amount of time taken to fabricate a PCB for a one-off project doesn't make it worth while. Partly because I dislike playing around with messy chemicals when I could be soldering the circuit. But mostly because fundamentally, if you're going to use a PCB you have to know the circuit before you build it. I'm not clever enough to design a circuit first: I design it as I build it, a process often incorporating large doses of trial and error. Therefore for RF circuits I tend to use "ugly" construction over copper clad board groundplane. Some of the modules in this project used semi-PCB's - the integrated circuits soldered directly onto the board, and surrounding components "ugly" style. I make a few tracks by cutting away the area in between the tracks with a sharp craft knife.

PCB's could easily be used for the modules, paying attention to ground planes and keeping all traces as short as possible, particularly in the VHF sections like the first mixer module. In my case I cut the integrated circuit pins short and solder them direct to the tracks side of the board, "surface mount" style. If other construction methods are used, distributed capacitance may be different. This would require some experimentation with the values of the very small capacitors in the VHF oscillators to obtain the correct frequency range.

Coaxial Connections

For intermodule RF connections I used SMB connectors. These are very expensive, but I was fortunate

Any other types of coaxial connectors construction (I know of) a paper alternative would be the F-series satellite

DC Connections

All DC connections to the RF modules are made using feed-through capacitors, purchased some time ago at a rally. Simply feeding a wire through a hole in the module wall probably isn't going to provide the same degree of RF shielding.

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The junk box frequency synthesiser also contained a large number of inductors, mostly 33uH and about the size of a largish resistor but coloured black. Every DC connection is filtered inside the RF module using a 33uH inductor in series and 10nF capacitor to ground on either side. This forms a Pi-network low pass filter and efficiently removes any RF noise which might be present on the DC line. The absolute value of the inductors and capacitors isn't that important: if other values are available in the junk box, so be it.

Final Module Layout

The modules were mounted on a single sheet of circuit board (PCB) material, along with the power supply. The ph