

## General Notes Regarding Construction of the Kanga US Spectrum Analyzer

This kit is really more of a “Parts for a Project” than a “Heathkit Style” step by step kit. If that is not what you were expecting, pack the kit right back up and send it back to me for a refund!

The kit as provided only includes the PC boards and board mounted parts along with the pots and feedthru capacitors. A block diagram of the SA along with schematics, Board layouts, and a parts list for each module is included. No detailed instructions are provided. You will need to provide the hookup wire, connectors that are used between the modules and on the front panel, hardware, +/- 15 volts, and the knobs for the front panel. You will also need to provide the inter-stage shielding that is necessary for good performance of the Spectrum Analyzer. That is critical to the final overall performance of the Analyzer.

Several hundred Spectrum Analyzer “kits” were sold several years ago before the flood that shut Kanga down for a period of time, and there are probably several hundred different versions that have been built. There is no “correct” way to build it. You will need to lay it out, construct it, *test it a stage at a time*, and get it all going as a system. Shielding and proper interconnections are critical to the final overall performance of the unit. Kanga supplies an optional set of die cast boxes that can be used to shield each of the modules, or you can supply your own, or build your own from materials as different as PC board or aluminum sheet.

The SA requires plus and minus 15 volts dc to operate. I bought a couple of cheap 15 volt open frame supplies from MPJA:

<http://www.mpja.com/Power-Supplies/departments/1/>

and used them to provide the power. They mounted internally in the finished SA. You will need an ON/OFF switch – mine had no ON/OFF switch – it was unplugged when I wanted to turn it off!

W7ZOI's web page ( <http://W7ZOI.net/tech.html> ) provides a lot of background material that is useful when you are building the SA, and will be useful if you decide to modify it when you are done building. SA's using this basic design have been built that go up to 1 GHz or more.

I have set up a Yahoo group to provide tech support for anyone building the SA. It is moderated (to keep out the spammers), so you will need to get “approval” before you can start posting to the group. Go to [yahoogroups.com](http://yahoogroups.com) and search on KangaSA.

Other links that will be helpful when building the SA include:

[http://www.kangaus.com/spectrum\\_analyzer.htm](http://www.kangaus.com/spectrum_analyzer.htm)

<http://www.minicircuits.com>

A few notes on the individual modules are below.

### **Time Base Generator -**

When completed check that the wave forms produced by the module are as expected. Check out W7ZOI's web page ([http://w7zoi.net/SA\\_Oct08.pdf](http://w7zoi.net/SA_Oct08.pdf)) if you are unsure of what to expect. It is the one board that does not have to be shielded in the final unit. As you can see from my photos, I mounted it on the top of the box that contains the IF/LOG Amp.

### **VCO -**

The POS-200 is mounted so that the letters "MCL" stamped on the case are above the "MCL" printed on the PC Board. The dots stamped on the top of the MAV-11 mmic's are mounted towards the dots printed on the PC Board. The ADE1- H mixer is mounted so that the dot on the top of the chip goes over the dot printed on the PC Board.

When completed you can connect the Time Base Generator to it and be sure the frequency output is in the correct range and has the correct amplitude.

### **IF/Log Amp -**

The Toroidal transformer in the first stage is mounted on the PC Board so that the wires from the 8 turn winding go into the square pads. The two turn winding wires are soldered in the round pads.

The IF/Log amp should be built and tested in stages. The final amplifier (CA3140) can be built and tested with a dc signal fed into the input. The gain of the stage should be about 4.25, that is, if a 1 volt signal is applied to the input, 4.25 volts should appear at the output. Then the AD8307 stage should be built and tested. You should apply a 10.7 MHz signal to the input and vary it between +10dBm and -70dBm. The output of the 8307 should vary between about 2.3 volts (+10dBm in) and .25 volts (-70 dBm in). The output of the CA3140 stage should be between a bit less than 10 volts (+10dBm in) and 1 volt (-70dBm in). Peak the LC filter at the input of the 8307 at 10.7 Mhz.

The AD603 should have about 5.5 volts on Pin 2. The DC voltage on pin 1 should vary between about 4.5 and 6.8 volts giving a gain range of about -10 db to about +30 db through the stage at 10.7 MHz. The single transistor amplifier at the front end of the board will have a gain of about 9 db at 10.7 MHz.

## **Resolution Bandwidth Filter -**

The large winding on the two toroidal transformers goes in the two pads farthest from the relays on the board. The small winding uses the two holes closest to the relays.

The Resolution BW Filter should be fairly straight forward – peak the trim caps with a 10.7 MHz signal.

## **Second Mixer and Second Local Oscillator -**

There have been some circuit changes to the Second LO since the original article was written, but alignment is still the same. Replace the 100 MHz crystal with a 100 ohm resistor (tack solder it in place) and peak the trim cap for 100 MHz. Then pull out the resistor and put in the crystal, and assuming the voltage levels are right, you will be good to go!

The dot stamped on the top of the MAV-11 mmic is mounted towards the dots printed on the PC Board. The ADE1-H mixer is mounted so that the dot on the top of the chip goes over the dot printed on the PC Board.

## **110.7 MHz Band Pass Filter -**

The 110.7 MHz BP Filter has been changed since the original article was published. Check out the W7ZOI Web page for details on the upgrade. No PC board is supplied for the 110.7 MHz BP filter. It is constructed on scraps of un-etched copper-clad PC board. The PC board material can be used to make the shields between the sections of the filter, or brass flashing purchased from a local hobby shop can be used. Once it is constructed and aligned, a top cover of PC material or brass can be soldered in place. Good shielding is needed here. Go to: [http://w7zoi.net/mixed-bag/mixed\\_bag.html](http://w7zoi.net/mixed-bag/mixed_bag.html) for details on building the filter.

## **70 MHz Low Pass Filter -**

The 70 MHz LPF has been re-designed to use a PC board and SMT parts. Be sure you get the right SMT parts in the right places on the PC board, button it up in a shielded box, and run a quick check to be sure it is working as expected – i.e. a flat response below 70 MHz and roll off above 70 MHz.

## **Interconnection Between the Modules -**

The first SA I built several years ago (before the flood!) used RCA Phono Plugs just to prove it could be done. It worked just fine. W7ZOI's web page has a good writeup on

their use.

The second SA I built used BNC connectors for interconnections. They worked fairly well, but took up a lot of room in the SA. The next one I build will use SMA connectors and smaller coax.

You could even build the SA using no connectors. W7ZOI has info on his web page about feeding the signals thru the shields between the modules to the correct signals (and only the correct signals) get to the right place!

Enough feedthru capacitors are provided so that all the power connections to each module can be properly bypassed. The Pot connected to the IF/LOG Amp should also use three feedthru caps to get the leads in and out of the module.

### **Final Assembly -**

It can not be stressed enough that the SA needs to be built in stages, and each stage aligned and tested separately before it is placed in the final unit. Be sure each stage is working properly before connecting the next stage!

### **Final Comments -**

When you decided to build the SA, you committed to doing a big project. The Kanga US kit is not a kit in the Heathkit tradition, but is more of a “project” that you will be building. Each one built will be different from all the others, but the design is solid and has been proven by several hundred successful builds already out there. Many people have modified and expanded/improved on the design. It is hoped that you will also do the same and incorporate your own improvements to the design based on the parts and materials you have available when you do the project.

If you have trouble, questions, or suggestions, post them to the Yahoo Group, or send me an e-mail directly ([n8et@woh.rr.com](mailto:n8et@woh.rr.com)) and I will do my best to help you. Keep in mind that this summer I will be gone from about July 1 through August 15 on our sailboat in the Northern Great Lakes. If you are really need to talk with me during that time – check 40 cw in the evenings!

Sometime this fall I hope to have a Tracking Generator Kit available to go with the SA. The prototype has been built and is working.

Have fun building!

73 – Bill – N8ET – Kanga US