

THE MUCH LOVED TS930 WITH A PANADAPTER

I've been using my 930 for many years on AM with my home brew external modulator/signal injector with good results. I thought it might be interesting to hear myself and make any needed adjustments. In order to do that I needed a ham band receiver. Not wanting to buy an old boat anchor or a little Chinese SW radio, I figured an SDR, very lightly coupled to the rig, would fill the bill.

I decided on an SDRPlay, RSP1A, because of the great reviews and reasonable price, \$120.00 at HRO. I hooked it up to an antenna and it does a good job. Listening to some broadcasters, I realized the audio was good coming from my less than dazzling laptop using headphones and the free SDRUno program from the same folks. Having made the necessary tweaks to the equalizer I was done.

With a slightly diminished bank account, I thought I needed to further justify my expenditure and put this little devil to an additional task, Panadapter. This is all the rage with the new rigs so it must be of some value. The easiest way to do this with the 930 is with a TR switch available from those masters of mechanical and electronic wizardry in Starkville, MS. Immediately foregoing that option, I set about to homebrew one.

While using the SDR, I noticed it was subject to images and other anomalies when connected to the antenna. It has input band pass filtering but the filtering is digital. I think this type of filtering can be easily overcome by strong signals. Someone more smarter than me can probably explain it so I will not try.

I decided against the TR switch project. Keep in mind using the SDR through a tuner would fix the problem, but one does not always use a tuner. Now what. The 930 has an IF output but is of no use for a panadapter. It is the 100Khz., 4th if signal, so the only signal there is the one the 930 is tuned to, taking the pan out of panadapter (I do make use of that signal for a synchronous AM detector). Tapping off the TR relay in the 930 eliminates the external TR switch but does nothing about filtering.

When Mr. Kenwood built the 930, he was kind enough to put in a bunch of band pass filters to keep the input RF amp from getting overcome with too much RF. These are very nice filters made out of old fashioned coils and capacitors. Many newer hams will not have heard of these things but they are described in ancient texts. The 930 is also conveniently built with a separate RF amp/mixer board with coax from the signal board, where the filters are, connecting to it, then back to the signal board with the first IF at 44.93mhz. The question becomes where to hook the SDR tap, at the filter output or the IF output.

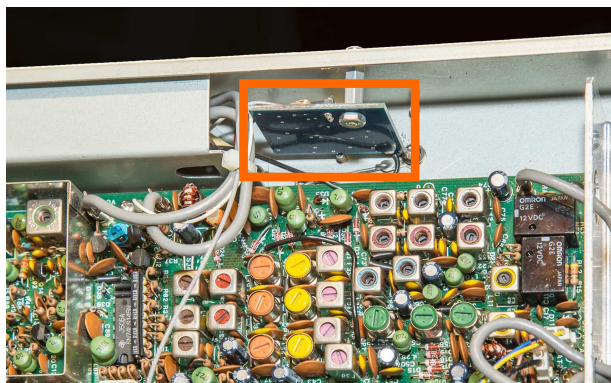
If we use the filter output (the filters are selected by the 930 when changing frequencies) we get all the signals present in the band pass of each filter and the SDR can look at them. SDRUno has very nice band select buttons so life is easy. Change the 930 band and hit the SDR band button and you are looking at the entire band on the computer. Tune the SDR around while listening to the computer and you can see and hear the whole deal. Match the 930 freq. to the SDR and your ready to go. (PIEXX converted 930's have even more options)

We can also tap into the IF output from the RF board. This has all the same signals except they are all converted to the 44.93mhz. IF band. The signals will move across the screen as the 930 is tuned but you can also change the SDR freq to look and listen to whatever is there as before. There is one difference however. With this method, the frequency displayed will be in relation to the IF center freq, 44.93Mhz so to have the 930 capture that signal you will tune the 930 until the signal is centered on the IF freq. displayed on the SDR. With the previous hookup, the SDR will display the actual freq of the signal and you would tune the 930 to meet it. Note, the IF signal from the RF board is before the first IF filter (roofing filter). If it wasn't, it would be useless for panning just like the 100khz. output.

Where to make the connection is a matter of personal preference. For those with a PIEXX board conversion, SDRUno will talk to the PIEXX using Omnirig software so the 930 and SDR will track each other and you can use either connection point and they will look the same. I am not doing that because my laptop is limited in power and I am not sure it can handle all the tasks simultaneously. If your computer has the horsepower, that would be the way to go and you will have a 21st century 930.

Once we have decided where to make the connection, how do we do it with minimal unpleasantness? Tacking an SDR in the middle of the RF input chain has issues. We do not want to upset the 930 making a really good receiver less good and we do not want to introduce crap the SDR may generate into the 930. What is needed is a Hi impedance input, unidirectional device, connected to a Lo impedance point. Fortunately both the filter output point, (RF board input) and the IF output point are Lo impedance. A very wide band op amp will fill the bill. If you have the skills you can build one but DX Engineering sells such a device made originally by Clifton Labs.

It has 4.7K input impedance, 6db gain, 80db of reverse isolation and very wide bandwidth. All the info is on the DX Engineering site. It costs about 50 bucks shipped.



The picture shows where I placed the board. The RF amp/mixer board is behind the shield to the left. I connected to the FRO jack which is the RF input. I also took DC power from the RF amp/mixer board through a 270 ohm resistor to drop it to the recommended 12 volts since the voltage to the RF board, RFB, is 18V.

As far as the output connection goes, I removed the receive antenna phono jack and selector switch and used the hole for the supplied SMA connector. You will have to bypass the switch so the 930 will get RF from the main antenna connector if you do this.

There are no ill effects to the 930 and the SDR gets some nice filtered RF to display. Makes for more interesting operating at significantly lower cost than a new rig



Keep in mind that when you transmit you will see your signal on the SDR. There is no way to shield the SDR input from the 100 watts floating around inside the 930. This is not a problem unless you listen to the SDR and you are using voice. It does not mute when you transmit, so any audio, including your transmitted signal if the SDR is tuned to the xmit freq., will come out of the speaker causing issues. I use a small audio mixer to mix the 930 audio and the SDR audio and send it to my outboard audio amp. I can then adjust what I want to hear. You could also build a mute box that would key off the 930. Headphones are another way. If you are using the laptop speakers, good luck.

As far as computers go, my old Laptop using a 2 core Celeron processor works ok. The computing power required is dependent on the total bandwidth the SDR is looking at. Except for 10 meters, the bands are about .5 Mhz. wide which is OK for the Celeron. If you want to make use of the SDR's full capabilities, for other activities possibly, you will need at least an I5 processor.

There is lots of info on Youtube about the SDRplay unit, and SDRplay has a great sight, check it out first.

Ed, K3UXN