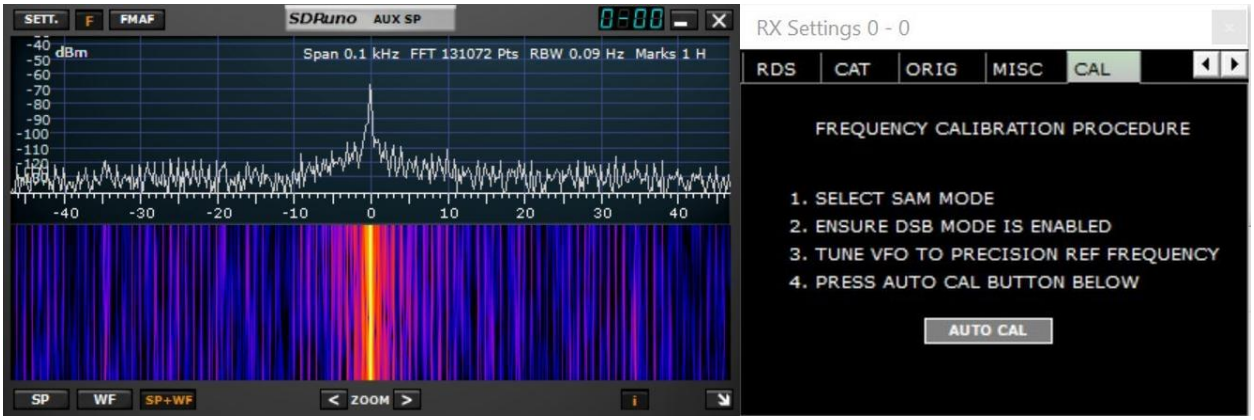
Using the RSP-1A for Frequency Measurements and Calibration

The SDRPLAY RSP-1A is an amazing receiver because of it's flexibility and price. I use it with the supplied software SDRuno and it is used as a piece of test equipment as much as a general purpose receiver.

SDRPLAY claims the frequency accuracy after calibration is 0.01 ppm (parts per million). Here is the quote from their spec sheet. "•In-field trimmable to 0.01ppm". This is very good and can be calibrated easily with WWV or any other accurate frequency source. I am assuming this accuracy is carried over to the SDRuno readout.



The frequency resolution is also amazing with down to **1 HZ** marks on the auxiliary spectrum display. The screen capture on the above left shows a total span width of 100 Hz with marks every Hz. The above right shows the calibration window.

I recently acquired a nice HP 8640B signal generator. It needed to be repaired and after that was done I wanted to check the performance. One of the things was the frequency calibration. I used the RSP-1A and SDRuno to do this.

After calibrating the RSP-1A against 10 MHz WWV I connected the 8640B to the RSP-1A. The signal generator was in the locked mode and happened to be on 2 meters at the time so I used the frequency that was selected. The RSP-1A was set to the signal generator frequency. It was then just a matter of adjusting the reference oscillator in the 8640B to zero on the auxiliary spectrum display. The frequency accuracy of the HP 8640B on 2 meters should be within 15 Hz of the actual frequency. BTW if this 8640B looks a little different than most, it is because it has the 001 and 004 options installed.

The RSP-1A spectrum display is very good for checking the deviation accuracy of a signal generator or a service monitor if of course they are capable of producing FM. The calibration can be checked by the Bessel zero method. I am not going to go into too much detail here but you can look up information about Bessel zero on the internet. There are two other articles on this website that may be of some use. They are"Setting Analogue FM Repeater Deviation" and "Calibrating the Deviation Monitor Using the Bessel Zero Method". You can find them by looking in the ODDS and ENDS tab. I made an XL spreadsheet back a number of years ago that you can use to view the required frequencies to produce carrier nulls or sideband nulls. Check the ODDS and ENDS tab here also for the spreadsheet. I used this approach to verify the FM accuracy of the HP 8640B signal generator.

I want to mention something about the WWV frequency accuracy. Everyone knows that the base frequency accuracy is exceptional. An issue is the propagation between the points. I found an old US government document on-line about this. It turns out that the propagation conditions, the number of hops and distance can affect the frequency accuracy at the receive end. Here is a quote from the document.

"Doppler effect arising from motion of the ionosphere still limits the typical usable accuracy of standard frequencies propagated over skywave paths to a few parts in 10^7, or perhaps a part in 10^8 under good conditions."

There is a big difference between a few parts in 10^7 and a part in 10^8. A number of years ago I put together at 10 MHz frequency source base on a HP crystal oscillator module (TCXO). It is shown elsewhere on this website. It is very stable and I check it periodically against WWV at 10 MHz. I have yet needed to recalibrate it and I certainly would have noticed even a 1 part in 10^7 difference. In my location I am probably one hop from WWV. Typically I believe it is a lot better than a few parts in 10^7 here. Generally the worst case for the Doppler effect appears to be between the night/day and the day/night transitions. This seems to make sense so don't do the calibration during these times.

Getting back to the RSP-1A, I have several frequency counters that have almost become redundant because of it. Not only can it accurately measure frequencies but in many cases it can do it remotely, for example measuring distant transmitter frequencies, something that frequency counters cannot do.

Another example, many years ago I put together a UHF repeater that was part of a 6 meter remote base. The remote base is now gone but the repeater still exists. It is located one floor down from the Ham shack. It is made up of 3 different radios but the receiver is GE. In order to adjust or check the receiver frequency the manual tells you to connect a counter to a test point and to adjust the frequency seen there to the operating frequency minus the IF. In order to check to see if the receiver is on

frequency now all I have to do is connect the RSP-1A to an outside antenna, tune it to the repeater receive frequency minus the IF and look at the leakage from the local oscillator. This works and if it needs a minor adjustment it's easier to do it this way than setting up a counter, although it may require one or two trips up and down the stairs.

To sum it up, the RSP series of receivers are nice units with multiple uses.

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