

Worth Another Look The SDR-1000 with an “Approved” Sound

Recently, in a series of *MT* feature articles, the topic was Software Definable Radios (SRD), possibly the greatest change to radio technology in the past 100 years. One of the SDRs we looked at was FlexRadio Systems’ SDR-1000 transceiver. However, I may not have given it a fair shake.

As the saying goes, penny wise and pound foolish. During my initial look at the SDR-1000 I went against FlexRadio’s suggestions and attempted to use an on-motherboard sound card. What a waste of time! The results were confusing, ever changing and ultimately useless.

In the operation of the SDR-1000, the PC’s sound card is a key element. The SDR-1000’s performance – dynamic range for example, is greatly influenced by the sound card’s performance. FlexRadio clearly lists the sound cards they have tested, support, and therefore which allow optimal performance of the SDR-1000. But when I looked at the price of these cards the cheapest was around \$100. Being frugal, I decided to dig out my PC card inventory and try a few of my old sound cards. One, an inexpensive Aureal Vortex PCI sound card “worked” and I used it for running the SDR-1000 in the feature article.

I had a nagging worry that perhaps I was not giving the SDR-1000 a fair chance. After all, every time I spoke with the good people at FlexRadio they would courteously but “strongly suggest” that I use one of their approved sound cards. But my sound card seemed to work, especially compared to the miserable results that I had with the on-motherboard sound card.

❖ I Get Feedback

After the third part of the SDR feature was published I began getting feedback from hams who had tried using unapproved sound cards

which worked. But they found a “huge performance difference” when they broke down and bought one of the sound cards on the FlexRadio list. My worry seemed to be well founded. But the cost of the approved sound cards, starting at around \$100 still did not fit in with my fiscally responsible philosophy ... call it what you may!

With these facts in the back of my mind, over the next few months I began to regularly watch the market price for FlexRadio’s approved sound cards. I entered them as “Favorite Searches” on eBay and checked the going price periodically. But even used, their prices were holding in \$60 + range.

Then recently, I received an email from a major on-line computer store advertising the Turtle Beach Santa Cruz sound card at \$42 including shipping. I immediately recognized this sound card as an approved FlexRadio card. Again, with my “fiscally responsible philosophy” I checked the prices of used Santa Cruz cards on eBay.

When I saw that they had fallen into the thirty-dollar range including shipping and handling, I *knew* it was time to get one. Watching the auctions for another week, I finally grabbed one at \$24 including shipping. Now a Flex Radio Systems “approved” sound card was very affordable! So, let’s see how to install and use the Turtle Beach Santa Cruz sound card with the SDR-1000. Then we’ll see its effect on SDR-1000’s operation.

❖ Installation

First, remember to disable any on-board sound cards, usually done via the BIOS setup. Uninstall existing PCI sound card software drivers using Windows Control Panel. Or use the “uninstall” function in the old sound card’s program folder. Shut the PC down, remove the AC cord, and then remove the old sound card.

Next, install the Santa Cruz sound card in a PCI slot in your PC. Try to keep it away from the video card where it may pick up unwanted signals.

Using the included instruction manual and CD from Turtle Beach, the installation was quick and easy on my Pentium III, 1GHz PC, running Windows XP Professional.



Figure 2 - Power SDR setup screen - With a Santa Cruz sound card it’s a snap!

Remember, follow the few simple steps in the manual *exactly and in the exact order*. Your Santa Cruz card sound should now be operational and ready to use with the SDR-1000.

❖ A Quick SDR-1000 Overview

The SDR-1000, Software Defined Radio (SDR) transceiver operates as a general coverage receiver in the range 11 kHz - 65 MHz. Modes of operation include: AM, Sync AM, USB, LSB, DSB, CW and FMn. Filtering for DRM mode is included and will interface to the commercially available DRM software. See the November 2004 *MT* article SDR Part 1 for a detailed description of SDR-1000, including a block diagram.

The functions of an SDR-1000 are defined in software and it uses open source software code for programming the digital signal processing chip (DSP) and its control software. As such, a knowledgeable user can modify or add features/functions to the SDR-1000. Of course, these will be limited by the hardware.

❖ SDR-1000 Hardware

A true Black Box, the SDR-1000 is housed in a black metal enclosure (see Figure 1), measuring 10” W x 8½” D x 4” H (25.4cm x 20.8cm x 10.2cm). It requires a 13.8 VDC power supply capable of providing 1.25 amps. The SDR-1000’s front panel is simplicity itself with just an on-off switch and a microphone jack. The back panel has an antenna connector, the parallel port and jacks for the input to the left and right channels of the sound card.

The SDR-1000 includes a transmitter that covers the 160 meter to 6 meter ham bands with a 1 watt peak envelope power (PEP) output. The price is \$875 plus shipping. A receiver-only version is also available from Flex Radio Systems.



Figure 1 - The black box SDR-1000

See <http://www.flex-radio.com> for pricing and details. Again, for details of the SDR-1000 operational circuitry see "Software Definable Radios Parts 1, 2 & 3" (also available on line under Reviews 2004 & 2005 at <http://www.monitoringtimes.com>).

❖ Power SDR

The software that runs the SDR-1000 and is provided on the Flex Radio site is called Power SDR. Flex Radio continues to produce new versions of the software in an effort to improve and expand the performance of the SDR-1000. Although version 2.0.0 was about to be released, it was not ready for this article deadline. So we used version 1.1.9. This Zip file is a little over 1.1 MB in size, which allows it to be stored on a floppy.

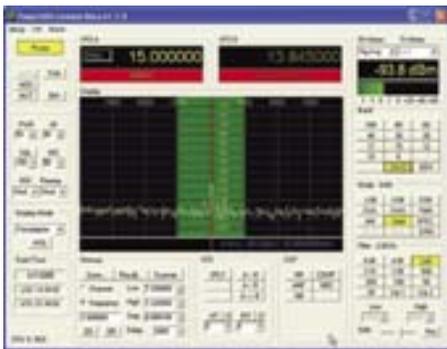


Figure 3 - Power SDR Version 1.1.9 main operating screen. Notice the "preamp" control on the left and the level of the background noise.

After unzipping and installing Power SDR it then guides the user through a set of set-up questions. Figure 2 shows exactly how easy it is, if you have an approved sound card such as the Turtle Beach Santa Cruz. Just highlight its name and hit "Next."

As seen in Figure 2, Flex Radio supports five other sound cards in addition to the Santa Cruz. For supported sound cards all audio parameters are pre-determined and require no user intervention. And best of all, the SDR-1000 works great the first time. No messing around with a number of interactive parameters and then wondering if the performance is optimal. It's all done for you by the Power SDR program.

❖ More Power SDR to You

Once you answer the four or so set-up questions, the main Power SDR screen is displayed, Figure 3. A number of important changes have been made in the 1.1.9 version as compared to

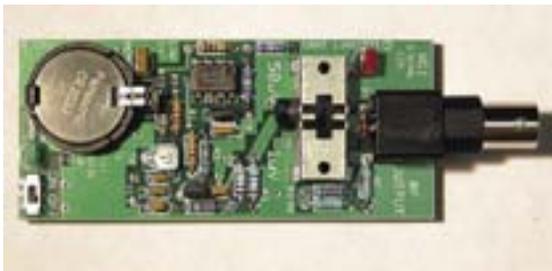


Figure 4 - Elecraft's XG-1 - The \$39(!)precision signal and level calibrator (after assembly)

the version used in our original review. One of the most impressive improvements is the automatic linking of three functions: IF (gain), Attenuator and Gain. The three have been combined into the "Preamp" setting, at the left side of the screen of Figure 3. This new feature makes operation much simpler, while maintaining optimum receiver performance. For most monitoring situations I found that the "Med" (medium) setting gave the best results.

❖ Frequency Calibration

The frequency calibration routine has been greatly simplified in version 1.1.9 requiring no math calculations. All it takes is a strong signal of known frequency, for example, WWV at 10.000 MHz. Clicking the frequency "Start" button found on the "Setup" menu's "General" tab screen, does it all in one quick action. These changes will be included in version 1.2.0.

❖ Exact Level Calibration

For the purists among us (read pedantic geeks) who put their faith in absolute measurements (in a relative world) the SDR-1000 can fit the bill. The SDR-1000 can directly provide "exact" signal and noise measurements. However, first it must be calibrated using a standardized signal generator. If you don't have a thousand dollar calibrated signal generator lying around the house, there is a \$39 alternative.

The XG-1 calibrator kit from Elecraft generates a fixed-frequency 7.040 MHz signal with "highly-accurate 1 microvolt and 50 microvolt output levels." This is a kit, so some dexterity with a soldering iron is required. However, the six page manual is very well written. The one page of step-by-step, detailed assembly takes between one to two hours to accomplish inserting and soldering the thirty components. See Figure 4 for the XG-1's fully assembled printed circuit board.

I would put the required electronic construction ability somewhere between intermediate and beginner. I didn't find any component particularly difficult to solder to the board. The manual includes simple ohmmeter testing procedures to verify correct assembly, so you don't need to turn the XG-1 on and blow it up to find that you have a problem. The XG-1's output is clean and constant in frequency and level.

The other pages of the manual describe the circuit and detailed procedures for using the XG-1 to test receiver sensitivity, S meter calibration and signal to noise measurements. At \$39 (plus shipping) this tiny (1.5"W by 3.5"L) XG-1 is quite a useful device for Hams or SWLers. Check out the XG-1 and their other products at the Elecraft website <http://www.elecraft.com>. Tell them you saw it in *Monitoring Times*.

The XG-1 can be used to calibrate the SDR-1000's frequency and signal level to high degree of accuracy. This is simply done via two clicks in the Power SDR "Setup" menu's "General" tab screen.

❖ Sound (Card) Differences

The most obvious difference that the Santa Cruz sound card made to the SDR-1000's operation was in the background noise level. It was noticeably quieter, as can be seen in Figure 3's spectrum display, showing the noise floor down below -94 dBm. The Santa Cruz sound card also gives an improved signal to noise level, which was very obvious on weak signals. The signal in Figure 3 - a very, very weak WWV on 15 MHz - was completely "copyable." In my opinion, the Santa Cruz greatly improves the performance and operational stability of the SDR-1000 as compared to my non-approved and unsupported sound card.

❖ Always Improving

There is no question that the Turtle Beach Santa Cruz sound card made a big difference in the performance of the SDR-1000, just as Flex Radio indicated to me many months ago. To all the people that emailed me saying that would be so, all I can say is, you were right!

The 1.1.9 version is another positive factor in the SDR-1000's improved performance with its simpler gain and attenuator controls and other enhancements. Version 2.0.0 (estimated release date 10 April 05) will retain all of V1.1.9 features and add some. For starters, in version 2.0.0 the AGC has been tailored to produce cleaner audio and professional sound cards have been added to the approved auto set-up list.

Check Flex Radio Systems' website at <http://www.flex-radio.com> for the latest version of Power SDR and product information on the receive-only SDR-1000/ROE. Till next month. Keep sending me your input. I AM listening.

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