

## FLEX-1500 SDR Transceiver Review, Part 2

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Last month, in Part 1, I introduced the technology and some of the features of FlexRadio's FLEX-1500 QRP SDR HF transceiver. This month it's time to connect the radio to a PC and an antenna. Be sure to read Part 1 if you haven't done so.

For once, my tendency to procrastinate has paid off, as FlexRadio just released *PowerSDR* version 2.0.22, a new non-beta release of the Windows PC software that makes the magic happen. Technically in beta for the better part of a year, the FLEX-1500 is now "official."

### ❖ Tiny Radio, Tiny Box, Easy Connections

Neatly packed inside the small box is the radio, user manual, a quick-start guide and the usual paperwork, a driver CD, a BNC-to-UHF female coaxial adapter, a dc power cable with a plug, and a USB cable (with RFI-suppressing ferrites at each end).

To get started you'll need the USB and dc power cables that came with the radio; an HF or 6-meter antenna or dummy load; stereo headphones or computer-type powered speakers (the plug *must be stereo* to avoid shorting out the radio's audio amplifier); a stable 13.8-V dc power source that can supply at least 2A peak; a Windows PC (XP, Vista or Windows 7) with a USB 2 port; a mic (PTT switch preferred, no VOX) and/or CW paddles/keyer/straight key.

Making the initial connections is straightforward. Before diving in, however, at least glance at the included Quick Start Guide. After making the physical connections to the transceiver (don't power up the radio yet), install *PowerSDR* on your shack PC. Instead of using the installer supplied on the disk, visit [www.flexradio.com](http://www.flexradio.com) to obtain the latest version.

Carefully follow the installation procedures outlined in the Quick Start Guide. Depending on your specific version of Windows and its "Windows update status," you may have to install some .NET files and .NET service packs to complete the installation.

The initial power-up will prompt USB port handshaking and driver installation. Vista and Windows 7 will load multiple drivers in the background and will notify you when everything's complete. Windows XP users will probably have to click through several instances of the "Found New Hardware" wizard, but the end result is the same: *PowerSDR* and all necessary drivers are installed, the radio is attached and powered up, and your SDR experience is about to begin!

At first launch *PowerSDR* will run a short optimization routine. When everything's loaded, *PowerSDR*'s main screen is displayed, but the software is in standby mode until you click on the START button in the upper-left part of the main screen.

The urge to start clicking on buttons and controls may be overwhelming at this point, but in addition to audio input/output and antenna port settings, you will probably want to adjust the buffer settings for the USB and audio drivers *before* you get too far along. For some PCs and some USB hardware these settings can be critical, especially when transmitting Morse code. Carefully follow the set-up instructions in the Quick Start Guide, the User's Manual and on [www.flexradio.com](http://www.flexradio.com). Setting things up correctly from the get-go can eliminate a lot of potential frustration down the road.

### ❖ A Smorgasbord of Options

Because the FLEX-1500 is a pure SDR – and every imaginable under-the-hood setting can be tweaked to your personal preference – configuring the radio can be fabulous *and* frustrating. For control freaks, the sheer magnitude of all possible customizations is a dream come true.

If your favorite radio has three controls, the FLEX-1500 (or any SDR) may not be for you. Most of the settings are behind the scenes and don't require constant fiddling, but there are dozens – even hundreds – of possible settings and adjustments, especially if you're transmitting, using the radio with digital-mode or logging software, or interfacing to external amplifiers or transverters.

Enjoying the full measure of the '1500's capabilities will require some effort, study, trial and error, and a willingness to get your hands

dirty (digitally speaking). You may also have to make major adjustments to your PC and its operating system (or buy/build a new one or wipe your existing PC and install a fresh copy of Windows).

### ❖ The Main Screen

As presented by *PowerSDR*, the FLEX-1500's virtual front panel can initially seem a bit overwhelming, but if you take a step back, most of the functions should seem familiar. The software controls look and work just like their hardware counterparts.

On the right is a multifunction "S-meter" (nicely calibrated) and buttons for changing bands, modes and filters. Frequency readouts for VFOs A and B run across the top of the screen, and along the left-hand side you'll find controls for PTT, RF and AF volume, squelch, AGC and preamp levels. The bottom of the screen includes familiar controls for RIT, XIT, noise-blanker and keyer settings, but then displays some less-familiar controls for stereo audio, binaural "3-D" reception, multi-RX panning (multiple audio source L-R panning, like on a DJ's audio mixer), and CPU utilization (which leaves no doubt that this is a PC-radio hybrid!).

The Main Attraction is the large spectrum display in the center of the screen that shows a 48-kHz swath of the band in real-time, with your tuned frequency near the center of the band scope (certain settings and adjustments allow precise centering, if desired). This spectrum display graphically shows signals up and down the band.

If you see a signal emerge from the noise, you can simply click on it with the mouse pointer to tune it in. Rotating the scroll wheel on your mouse makes for easy fine tuning (tuning step size can be adjusted on the main screen). The band scope is an SDR's "killer app." Once you use it, you won't want to be without it.

I don't have nearly enough room to describe operation of the '1500 in detail. The User Manual does a great job of that, and FlexRadio's web site and community-based online user forums can help you with just about any issue.

### ❖ Transmitting

After you've gotten comfortable with turning the radio and *PowerSDR* on and off, explored the many set-up menus, and marveled at the usefulness of the band scope, it's time to transmit. The easiest TX mode to get started with is SSB (or other voice modes). The front-panel mic jack has the same pinouts as a late-model Yaesu hand



Final Rating, 4 out of 5 stars



mic. If you don't have access to one, wiring up an RJ-45 (LAN cable style) plug or adapter isn't difficult. The diagram in the user manual will probably be all you need.

Although the FLEX-1500 doesn't support VOX operation, *PowerSDR* rewards its "PTT pressers" with a variety of powerful DSP-based sonic and performance enhancements, including a multiband EQ, noise gate, speech compressors, and more. Whether listening to a second receiver in my own shack or talking with other ops on the air, all audio quality reports were favorable.

Depending on your specific PC hardware and operating system, sending Morse code may be more of a challenge. Prior to *PowerSDR* version 2.0.19 RC1 (the release candidate from March 2011, just before the first full, non-beta release), the rig's CW-sending difficulties were well known. Prior to version 2.0.22 I had to use an external keyer and employ manual T/R switching via foot pedal. Although nostalgic, "going old school" took some getting used to (but the radio's outstanding receiver performance was too good to ignore).

As it turns out, the problem is related to the intricacies of using real-time USB signals to synchronize the flow of data between *PowerSDR* and the FLEX-1500. More expensive FLEX models use Firewire instead of USB and do not have these issues. It's important to optimize the USB buffer settings mentioned earlier to minimize any potential Morse code transmission issues. More aggressive buffer settings – if your PC and its USB hardware can handle them – allow the radio to more quickly sense and respond to key and keyer paddle inputs, which make for better keyer performance and better T/R (break-in) response.

After testing various PCs and aftermarket USB2 adapter cards, I found a combination that "feels right" through 25 WPM or so (my maximum ragchew speed). I have also settled on "semi break-in mode" using a 400-ms T/R delay. With this setting I can't hear between elements, but the slight delay eliminates a lot of relay chatter (the T/R relay is loud) and makes for a usable CW machine. The engineers at FlexRadio will likely continue to improve the radio's CW timing performance, as evidenced by the tremendous improvements made over the past 10 months.

## ❖ External Software Interfacing

Making the FLEX-1500 work with external rig-control, logging and digital-mode software is the most challenging part of integrating the '1500 into your station. The FLEX-1500 is a capable digi-mode transceiver that plays nicely with most external software. Because the radio is software-defined, however, making audio and CAT connections is quite a departure from what you're probably used to and requires additional software and some poking around "under the hood."

Remember: When the FLEX-1500 is powered up, *PowerSDR* is running on your shack PC. Because your logging or digi-mode software is also running on the same PC, there's no need to connect the usual audio, COM or USB cables to interface the ham radio software with your

transceiver, because they're already running on the same PC! Defining these connections in a way that satisfies your external software is the tricky part.

Let's start with audio. Because *PowerSDR* already has access to the radio's RX and TX audio, you don't need to route those signals through an external interface to bridge the gap between radio and PC. You do need to route the audio from *PowerSDR* to your digi-mode software, however, which is most commonly done by using a utility program called *Virtual Audio Cable* (VAC). Just like it sounds, VAC creates a user-defined virtual connection between *PowerSDR* and your digi-mode software. Two virtual connections are defined, one for RX audio in, the other for TX audio out. If you want to pipeline the radio's RX audio to multiple programs at once, simply define additional virtual connections.

VAC, which is widely used in PC-based audio and video production, is an elegant solution, but it's not included with the FLEX-1500. To get a legitimate copy you need to purchase it from its author at <http://software.muzychenko.net/eng> (\$30 at press time). Some *PowerSDR* users report success with *VACard*, a similar program available for free at [www.datanab.com/audio/VAcad.htm](http://www.datanab.com/audio/VAcad.htm). Sooner or later, VAC or something like it will likely be bundled with FLEX radios or built into *PowerSDR*.

Defining similar internal, virtual connections between logging and rig-control software and *PowerSDR* requires the use of a virtual serial port (VSP) utility. Ultimately, VSP software works a lot like VAC software, but configuring it is less intuitive and often more difficult. FLEX owners typically use vCOM (free, XP only), VSPmanager (free for licensed hams) or comOcom (free). VSP software isn't supplied with the FLEX-1500, either, but I expect that it will one day be built into *PowerSDR*.

To interface with logging and rig-control software, *PowerSDR* uses the Kenwood TS-2000 CAT command set. Getting everything set up and working with virtual audio and COM pipelines can be a challenge. Once everything's installed, actually using all of the integrated software can also be challenging.

## ❖ Issues

In addition to the CW/keyer/USB timing issues mentioned previously, a few other issues popped up during testing. When my test radio transitions from TX to RX, there are noticeable audio "pops" or "clicks." This is most pronounced when pressing and releasing the TUNE button. At first I thought that optimizing the USB and audio buffer settings would cure this, but FLEX engineers told me that the issue is being researched and will hopefully be resolved in a future release of *PowerSDR*. The disturbance can be minimized by adjusting the AGC and AGC-threshold settings, but it's still a bit "clicky."

I experienced a few BSODs (blue screens of death) in Windows 7 testing and had to change some settings to prevent Windows 7 from "sleeping," a condition from which *PowerSDR*, for some reason or another, would never "wake up." After I disabled sleep I had no more BSODs.

## ❖ Impressions and Conclusion

At this point in the review it's important to point out that the FLEX-1500 is arguably the least expensive 160-6 meter transceiver on the market. Despite that, its receiver performance, as evidenced by extensive tests at Sherwood Engineering, holds its own when tested against the best ham rigs ever made, many of which cost thousands or even tens of thousands of dollars more. It's a QRP transceiver that offers rare (probably unique) built-in transverter connectivity (which, unfortunately, I was unable to test). Thanks to *PowerSDR*, the '1500 constantly evolves and improves. The little FLEX was designed to provide a low-cost introduction to the world of software-defined radios. It succeeds admirably.

Copying signals under any band condition is a snap. Thanks to the rig's adjustable AGC threshold, razor-sharp filters, point-and-click band scope tuning, superb close-in dynamic range, and effective DSP-based noise blankers and noise-reduction systems, I easily copied stations I would have struggled to copy with my other radios.

I know it's a ham rig, but the FLEX-1500 is a fantastic shortwave receiver. You can tune in AM stations with a single mouse click, then jump back and forth between AM, synch-AM, USB or LSB modes without hearing even a hint of frequency shift or heterodyne.

*PowerSDR* is so feature-rich that, even at the end of this two-part review, many of the radio's niftiest features haven't even been mentioned. One of the most useful is Multi-RX mode. The '1500 doesn't have a built-in secondary receiver like its FLEX-5000 sibling, but as long as both signals are inside the radio's 48-kHz "hardware digitizer window," you can simultaneously listen to VFO A in one ear and VFO B in the other! If you're operating split you can listen to your receive and transmit frequencies at the same time (stereo).

Depending on your preferences, for better or worse, the features and the killer RF performance come with the ergonomic realities of a PC-based radio. Until you try one for yourself, on your own hardware, you won't really be able to predict how you'll react to the SDR experience.

I'm absolutely thrilled with the '1500's receiver performance, feature set, and price tag. After using one for a few months, operating without a band scope just seems wrong! I still prefer traditional front-panel knobs and switches, but thanks to the FLEX-1500's raw performance, *PowerSDR* is growing on me.

If you're ready to experience the leading-edge technology called SDR, you won't have to go it alone. FlexRadio Systems provides top-notch technical support on the phone, through extensive training and resource materials on its web site, and through a helpful, well-attended online community.

All FLEX models are designed, manufactured, assembled, tested and calibrated in the company's Austin, Texas facility. The FLEX-1500 transceiver sells for \$649 and is available from [www.flexradio.com](http://www.flexradio.com) (13091 Pond Springs Rd. Suite 250, Austin, TX USA 78729; 512-535-4713).