

bhi Ltd ParaPro EQ20B-DSP

Reviewed by Bob Allison, WB1GCM
ARRL Laboratory Assistant Manager
wb1gcm@arrl.org

It is undeniable that audio clarity is necessary for two-way radio communications, especially when operating for an extended length of time. Achieving audio clarity is difficult when the intended received signal is competing with manmade and/or atmospheric noise. Muffled or tinny transmitted audio also adds to operating fatigue.

A device that can reduce noise and improve audio clarity is the bhi ParaPro EQ20B-DSP, a modular audio power amplifier with digital signal processing (DSP) noise filtering, parametric equalization, and Bluetooth input. Note that there are three other versions available — the basic EQ20, the EQ20B with Bluetooth input, and the EQ20-DSP with DSP filtering.

The DSP features can reduce the types of background noise many amateurs experience. This noise reduction, paired with equalization, improves audio clarity. A parametric equalizer is technically superior to the more familiar graphic equalizer, because a parametric equalizer boosts or cuts a selectable frequency, without the typical phase distortion of a graphic equalizer.

Out of the Box

Physically, the bhi ParaPro EQ20B-DSP is just about the right size — 3 × 5.75 × 4 inches. It doesn't take up much real estate on my ham radio desk, yet is large enough so each colored knob can be turned without bumping an adjacent knob.

There are six knobs total. The green **POWER/VOLUME** knob, at top left, is the only push-style knob. At top center, the blue knob is the **BASS** tone control, which selects the audio frequency in the range of 100 Hz to



1 kHz to boost or cut. The grey knob at top right is the **TREBLE** tone control, which boosts or cuts the frequency from 1 kHz to 10 kHz. At bottom left, the red knob is the **DSP NOISE FILTER** control. It ranges from **OFF** (bypassed) to **MAX**. At bottom center, the second blue knob is the **BASS** boost/cut control, allowing the selected frequency to be boosted or cut by -10 to +10 dB. At bottom right, the grey knob is the **TREBLE** boost/cut control, again -10 to +10 dB.

In addition to the colorful knobs, there are colored LEDs for each of the four audio inputs. At far right, the small, round, momentary-contact pushbutton selects Channel 1 (yellow), Channel 2 (red), Stereo (green), and Bluetooth (blue) as the audio input source. Headphone-level audio is available via a 1/8-inch stereo headphone jack (**PHONES**), located at the lower right corner of the front panel. The speakers mute when a head-

phone is plugged into this jack.

The rear panel of the bhi ParaPro EQ20B-DSP (see Figure 6) has banana-type (4-millimeter) jack and phono jack connections for stereo or monaural 8 Ω speaker hookup. I used a single, high-quality, 10 W, 8 Ω speaker for this review. For audio inputs, there are two monaural channels (1 and 2), using 1/8-inch monaural jacks. There is also a 1/8-inch stereo input jack. The only other hookup is a 2.1-millimeter, polarity protected dc power jack, for externally supplied 11 to 15 V dc.

The EQ20B-DSP comes with two sets of banana plugs for speaker wire ends, two 1/8-inch female-to-phono-male adapters, two 4-foot cables with 1/8-inch male monaural plugs, a single 4-foot cable with 1/8-inch male stereo plugs, plus a 5-foot dc power cable with a fuse holder. I was very pleased that bhi provided every cable I could possibly need with this device. I was equally pleased with the clearly written paper manual.

Bottom Line

The bhi ParaPro EQ20B-DSP is an easy-to-use device that improves the audio clarity of amateur signals. It can be used in other audio applications that require equalization and/or noise reduction.

Hookup

Input audio is specified as line-level or headphone-level audio. If the transmitter or receiver being used only has a speaker-level output, it is easy to overload the input. An audio pad could be used to attenuate the



Figure 6 — The rear panel of the bhi ParaPro EQ20B-DSP.

speaker audio to a low level. Without the pad, it is easy to overload the input.

The audio source currently selected is indicated by an illuminated LED. If the input level is high enough to start clipping, the LED will begin to blink rapidly. This happens at just slightly over 0.9 V peak-to-peak. The idea is to turn up the source audio until the LED flashes occasionally, then adjust the listening volume, using the ParaPro.

You will also need to connect an external speaker (or speakers, for stereo) to the banana or phono jacks. Once the initial setup is completed, the user can adjust the frequency and the level of boost/cut, with or without a wide range of DSP noise filtering level.

Lab Testing

I found a testing issue rather quickly. The dc supply ground and the audio output ground are at different potentials. Do not connect any negative speaker terminal to ground, or the unit will not work. A solution to this would be to use an isolation transformer at the speaker output, or simply do not connect the negative terminal to ground. The manual gives the reason for not connecting the negative terminal to ground as, "The outputs are Class D, to maximize power efficiency and eliminate the need for bulky heatsinking." The manufacturer also warns not to connect the speaker outputs together.

I measured the speaker output at 2.5 W per channel at 4% distortion with 13.8 V dc applied. That's plenty of audio for most applications. At full volume, the ParaPro draws just over 1.2 A in stereo mode and 0.65 A maximum in mono mode. At minimum volume, the current draw is only 118 mA.

The bass and treble operation were confirmed, using the Lab's HP 3561A signal analyzer and General Radio 1381 random noise generator. When engaged, DSP noise filter level measurements showed a reduced overall volume level, with the noise also reduced. The volume level on the ParaPro must be increased as the DSP filter level is increased. The amount of noise reduction, in this case, is not measurable in the Lab, but quite noticeable by ear, especially when using ParaPro with signals received on the air. For use with two radios, there is more than 60 dB of crosstalk reduction to prevent Channel 2 from being heard when the Channel 1 input is selected, and vice versa.

On Air

I first tried the bhi ParaPro EQ20B-DSP in line with a mobile HF transceiver's external speaker. In that radio, the DSP filter and equalization are only accessible by menu, and I hardly ever use that feature because of the inconvenience. An unfortunate trend in my neighborhood has been the rise

of manmade noise; nothing overwhelming, just a lot of noise sources at the S-5 level, mostly from inexpensive switching power supplies.

Having the ParaPro's DSP filter at my fingertips was not only convenient, the resulting clarity was far better, subjectively, than the transceiver's DSP filter response. I preferred about 9 o'clock on the red **DSP NOISE FILTER** knob for light noise. In general, as the **DSP NOISE FILTER** control is increased, the background noise is quieter, but the intended signal starts to sound like a cellular telephone. There is plenty of range in the effect, with the DSP level all the way up.

Overall, the ParaPro made my mobile HF transceiver sound better, with improved noise reduction. The **BASS** and **TREBLE** controls add their own set of subjective clarity. My preference is to boost the higher frequencies as signals permit when listening to short-wave or AM broadcast, with the **DSP NOISE FILTER** at 9 to 11 o'clock. The manual explains, graphically, how the controls work, but it all boils down to simply turning the knobs until you are satisfied with the sound. Boosting or cutting of the audio is not overly dramatic (only ± 10 dB), but enough for me to hear better.

Next, I used the ParaPro with an old favorite of mine, an early 1950s-era Collins R-390 receiver. Although it obviously doesn't have modern DSP features, it already sounds great with its flexible selectivity. Again, I was amazed how the ParaPro improved the clarity, especially with both AM and SSB transmissions. CW reception was improved, with weaker-signal intelligibility improved on 40, 80, and 160 meters. For that, I set the DSP control to 1 to 3 o'clock.

There was a lot of lightning in New England during this review and I noticed that the ParaPro can act as a lightning detector if the input audio level is adjusted to just before the audio source LED blinks. Received lightning noise, with the ParaPro

volume turned down, will cause the LED to blink. That's handy.

I had to try using the bhi EQ20B-DSP ParaPro in line with my old hi-fi equipment. If you happen to have some scratchy old records, this device can improve the listenability of even the most despicable record surfaces.

Lastly, the ParaPro can use Bluetooth as an audio input. This works by

selecting **BLUETOOTH** as the audio source, then enabling the Bluetooth scan function on your Bluetooth device. "bhi ParaPro-xxxx" should show up on the Bluetooth device list on your phone or tablet. Once synced up, you can play your device through the ParaPro, via Bluetooth, up to about 50 feet from the Bluetooth source.

Manufacturer: bhi Ltd., West Sussex, United Kingdom; www.bhi-ltd.com. Available in the US from DX Engineering (www.dxengineering.com) and GigaParts (www.gigaparts.com). Price: ParaPro EQ20, \$237; EQ20B (with Bluetooth), \$300; EQ20-DSP (with DSP), \$380; EQ20B-DSP (with Bluetooth and DSP), \$390.