

SGC ADSP² Add-on Audio DSP

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No doubt some Amateur Radio operators are in a position to buy the latest radio each time there is a leap in technology or features that pique their interest. For the rest of us, circumstances often dictate that we continue with our current stations for a generation or two of technology. The logical result is an interest in products that bring the promise of providing new features into our old radios. Turning old rigs into new has, after all, been a hot sell since the days of Aladdin!

So Just What is this Little Thing?

SGC first announced their *second generation* Advanced Digital Signal Processor (ADSP²) as an upgrade to their popular SG-2020 line of portable HF transceivers. They now offer two circuit board modules and a standalone speaker-mounted version of their ADSP² as separate products designed to be used to upgrade almost any receiver or transceiver. The units offer a combination of noise reduction, automatic notch filtering and bandwidth setting in widths designed for both CW and voice.

The two circuit board offerings (Figure 5) are designated as *low audio* or *high audio* versions. The high audio variety is designed to work at an input level of 0.1 to 5 V_{rms}, corresponding to communications receiver speaker level. This unit provides up to 5 W output, and is designed to be inserted between the receiver and its speaker. The low audio unit is designed for insertion into the receiver just ahead of the volume control (10 to 150 mV_{rms} level).

Both units require a 12 V supply and use the same miniature two-button switch to control functionality. One button controls the band-pass selection with successive applications cycling through voice (1.8 kHz), CW wide (500 Hz), CW narrow (100 Hz) and no bandwidth restriction. The second button cycles through noise reduction *one* (similar to their first generation at 13 dB), noise reduction *two* (26 dB) and no noise reduction. The au-

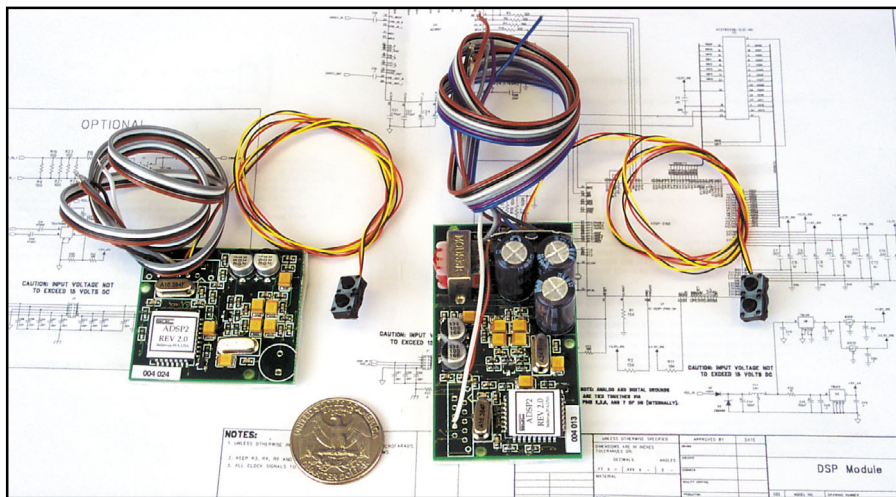


Figure 5—SGC ADSP² low audio (left) and high audio PC board modules surround a quarter. Note the miniature push button switches to the right of each unit.

tomatic notch filter (ANF) is on with either noise reduction mode. Note that unlike many ANF arrangements, this one has a delay so it will not notch out CW signals and thus is usable in all modes.

The module is also offered as a complete noise reduction speaker assembly. This has just one button and offers noise reduction and automatic notch filtering only.

Hooking it up and Checking it Out

For this review, we selected the two circuit board versions, since the speaker-mounted unit has the same specs as the high level unit for noise reduction and automatic notch filtering. I selected the high audio unit and adapted it with plugs and jacks for temporary connection to my Ten-Tec Paragon transceiver. It started up the first time and operated just as they said

it would! I was quite pleased with the performance in all modes (see Table 2). I operated my test unit outside the radio. Both PC board units come with double sided tape to allow installation anywhere there's enough space in or out of the radio. The pushbutton assembly's wires can be led out to a convenient spot and the assembly attached with mounting tape. I checked with SGC and found that there's nothing special about their buttons, so if you had space, there's no problem replacing them with more substantial ones. The button assembly provided is small enough to fit almost anywhere and works fine after a bit of practice.

The bandwidth reduction is very sharp and has steeper slopes by far than earlier analog filters offered to the amateur market. This is quite evident from a look at Figures 6 and 7. Using the narrow CW position (see Figure 6), I was able to completely eliminate all traces of a much stronger CW signal about 200 Hz from a desired signal just above the noise level. Note that with *any* audio filtering, the stronger signal will still get into the automatic gain control (AGC) process, and the gain of your receiver may be reduced by the strong adjacent signal. The cure is to

Bottom Line

SGC ADSP² second generation DSP modules can bring new life to older radios through modern digital signal processing techniques.

Table 2 SGC ADSP² DSP Boards

Manufacturer's Claimed Specifications

High Audio

Power requirements: 12 V dc, 0.5 A (full output).

Audio output: 5 W.

Noise reduction: "X1," 13 dB; "X2," 26 dB.

Tone reduction: "X1," 50 dB; "X2," 65 dB.

Audio response: Voice, 300-2100 Hz;
CW: wide, 400-900 Hz, narrow, 600-700 Hz.

Size (height, width, depth): 1.0×2.7×1.5 inches; weight, 1.1 ounces.

Low Audio (same as high audio except as noted)

Power requirements: 12 V dc, 0.08 A.

Audio output: 0.5 V_{rms}.

Size (height, width, depth): 0.4×1.7×1.5; weight, 0.6 ounces.

Measured in ARRL Lab

0.43 A, tested at 12 V.

As specified.

"X1," 10 dB; "X2," 26 dB.

As specified.

See Figure 7.

See Figure 6.


0.08 A, tested at 12 V.

As specified.

Even driving headphones didn't work well with this arrangement since the input level was too low to allow proper processor operation. The best arrangement I found was to use the speaker output as the ADSP² input (surprise, just as the instructions said) and then use a 200 Ω resistor in series with the headphones to allow sufficient input signal for good processing without blowing my ears out.

The other caution about the high audio unit is that neither side of the speaker (ADSP² output) can be grounded. This may be easy to do for the speaker itself, but if you install this in the radio, watch out for the grounded headphone or external speaker jack!

SGC provides detailed installation instructions for a number of popular radios on their Web site. SGC will also provide installation service in your radio if you wish.

Manufacturer: SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; fax 425-746-6384; **www.sgeworld.com**. Price: either PC board model, \$180; factory installation in your radio, \$50; ADSP² Standalone Speaker, \$129.95. 

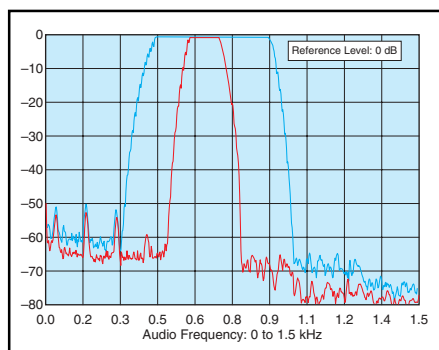


Figure 6—Filter response curves in CW mode. Blue line is CW wide. Red line is CW narrow.

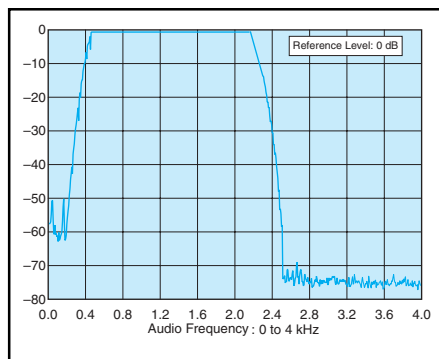


Figure 7—Filter response curve in Voice mode.

turn off the AGC and reduce the RF gain until the receiver is not overloaded.

The noise reduction is quite impressive. Level one gets you a significant reduction in background noise. With level two it's almost gone. I found it was easier to tune the receiver in level one than in level two, selecting the heavy processing only after I had tuned in a signal. Note that the bandwidth filtering and noise reduction can both be used at the same time, so significant noise reduction is possible by using them in combination. The DSP works best

on random background noise, although it helps with some impulse noise as well. The DSP does require a certain level of signal to process, so this will not make an inaudible signal readable, but will make tough copy much easier. Signals somewhat less than 2 S-units above the noise level (around 10 dB S/N minimum from lab tests) become easy copy. Weaker signals tend to disappear with the noise.

The automatic notch filter is dramatic. I first tested this by listening to AM broadcast signals in SSB mode and tuning slightly off-carrier to generate a beat. Push the NOISE REDUCTION button and the beat is gone in about two seconds with no noticeable distortion of the audio. A station tuning up within your bandwidth is there just long enough for you to notice, then presto he's history.

Why Would You Want One?

While this won't totally transform your aging Heathkit HW-100 into an Orion in one step, it does offer a lot of improvement to earlier generation radios and can raise the performance of many recent radios up a notch. If your radio doesn't offer multiple bandwidths, or you never got the filters and they're no longer available, this can provide a lot of benefit for about what one filter would have cost. Even if you have all the filters you need, the noise reduction and notch filter functions can make tough copy much easier (40 meter SSB after dark comes to mind).

What to Watch For

When they say *speaker level* that's what they mean! I first plugged the high audio unit into the headphone jack and tied it to a speaker. My transceiver has attenuation between the audio output and headphone jack. I could drive a speaker, but I had to turn up my AF GAIN control to the point that I was causing distortion. Heavy DSP processing of distorted audio isn't pretty!

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