The tiny assembly with the two push buttons for mounting on the outside of the transceiver.

SGC ADSP^2 Units and

The American company SGC has recently introduced DSP boards for retro-fitting in your transceiver as well as an external loudspeaker based on the same boards. Chris Lorek tries out the boards and Steve White the loudspeaker.

THE SGC ADSP2 DSP BOARDS

Many 'top of the range' transceivers and receivers currently include Digital Signal Processing (DSP) of received signals, either at the audio stage or at a low IF of a few tens of kHz. The difference this can make on signal intelligibility, and of course the ability to make that contact, in what would otherwise be very noisy conditions, is sometimes tremendous. If you ever thought you'd like to have built-in DSP facilities in your rig, SGC has come up with an interesting pair of DSP boards for retro-fitment.

There are two versions of the SGC ADSP^2 board. The first and smaller of the two is a 'low power' PCB, intended for fitting at the volume control stage of a transceiver. For this you'll need to break a wire or PCB track leading to the receiver's volume potentiometer and wire the PCB in series with this. The second is a 'high power' board, which instead is used at the loudspeaker output level stage. This simply wires in series with the receiver speaker. It'll provide up to 5W RMS audio output from its on-board audio power amplifier, drawing between 100mA (no output) and half an amp (at full output) from a 12V DC supply.

The low power board measures 43 x 37mm, and accepts an input level of between 10mV and 150mV RMS, drawing a fixed current of 80mA. The high power board measures 67 x 37mm, as it also has an audio power amplifier and an input matching transformer plus extra capacitors and resistors.

FILTERS

Apart from the physical size and input/output levels, each unit has identical specifications. There are two filtering modes, audio bandpass filtering and DSP audio noise reduction; each can be used individually or together. As well as a 'straight through' mode, three audio filter bandwidths can be switched in. These are 1.8kHz bandwidth (300-2100Hz) for narrow SSB, 500Hz bandwidth (400-900Hz) for CW, and 100Hz bandwidth (600-700Hz) for an ultra-narrow CW filter bandwidth. Out of band audio rejection is specified at -45dB. Two noise reduction levels can be switched in: the 'X1' noise reduction selection provides 13dB noise reduction, the second, 'X2', giving 26dB reduction. Automatic DSP tone notch is also included in noise reduction mode, giving rejection of -50dB on the X1 setting and -65dB on the X2 setting.

As the DSP system needs to analyse the incoming noise, there is a slight time delay between the incoming and outgoing audio using the boards. But this is only 6.5mS on the X1 setting, and 13mS on the X2 setting, which would be virtually unnoticeable even for fast break-in CW work (a 13mS period equates to over 150 dots per second).

OPERATION

As the boards are designed for internal fitting, three very thin wires from the board lead to a tiny assembly with two push buttons, each 6mm square and of the type you'd normally find soldered on to a PCB. A black rubber compound insulates the wire connections to the buttons, and these are designed to be mounted somewhere on the outside of your transceiver, although there's nothing to stop you wiring up your own push buttons of course. For example you could use one of the pairs of 'up/down' buttons either on the rig's front panel or the microphone if you otherwise just use the VFO.

Repeated presses of the first button cycles through the 1.8kHz, 500Hz, and 100Hz filters then no filter. Pressing the second button cycles through X1, X2 and no noise reduction/tone notch setting. There's otherwise no indication of what setting you're on, so you need to keep pressing the buttons and listening to find out what mode the DSP board is in.

INSTALLATION

Each of the PCBs comes pre-wired with lengths of insulated wire for input and output audio, 12V DC power and ground, plus the filter switch buttons. A six-

The SGC ADSP^2 speaker

The SGC ADSP^2 Loudspeaker

THE SGC ADSP2 IS a noise-reduction loudspeaker based on SGC's ADSP2 board. Equipped with just a single push button control, it offers 0dB, 13dB or 26dB of noise reduction. Pressing the button cycles around the three settings. [The bandpass filtering is apparently not implemented in the ADSP2 loudspeaker – Ed.]

My first impression upon unpacking the ADSP2 was that it felt reassuringly solid. Although it measures only 3 x 5 x 2.5in, it weighs 11oz (311g). Behind the front aluminium mesh grille are three LEDs – a red one to indicate power and two green ones to indicate the level of noise reduction selected. At the rear of the case two leads emerge through a rubber grommet, a 2m-long audio input lead terminated with a right-angled 3.5mm jack plug and an 85cm-long twisted pair for connection to 12V DC (10V-15V permitted).

Connecting the ADSP2 is simple, but note that it needs to be plugged into an external speaker socket as headphone sockets don't deliver sufficient audio to drive it.

PERFORMANCE

The plate on the back of the ADSP2 states "For Noise Reduction in AM, SSB, FM and CW operation", so I tested it on a variety of transceivers, frequencies and all the stated modes (plus RTTY). It is worth saying from the outset that I live in an electrically noisy neighbourhood, where it is common for the daytime background noise level on 160m and 80m to be S9.

7MHz SSB

I tested the unit when the background noise was around S7. The 13dB setting reduced the background noise and made just about everyone on the band more comfortable to listen to. When a station was approximately the same signal strength as the background noise the audio sounded 'robotic', which didn't seem too high a price to pay. Unless I was tuned to a particularly strong station the 26dB setting invariably resulted in robotic-sounding audio, and under particularly noisy conditions the audio started to break up. When listening to a weak station in the presence of an off-frequency station that was much stronger, the output often became unreadable. Returning to the 13dB setting invariably helped.

SHORT WAVE AM

On strong and weak stations alike, the 13dB setting reduced background noise and removed the 5kHz heterodyne that is often heard when stations are tightly packed-in – especially if the filters in a receiver are not the best. On this setting the speaker handled music as well as the spoken word, making it sound softer. The speaker alleviated phase distortion up to the point that it became severe. Interference from a short wave jamming station that was transmitting a wobbling tone akin to a car alarm was not substantially affected on either the 13dB or 26dB setting. On the 26dB setting the audio of strong stations sounded robotic and weak stations sometimes broke up.

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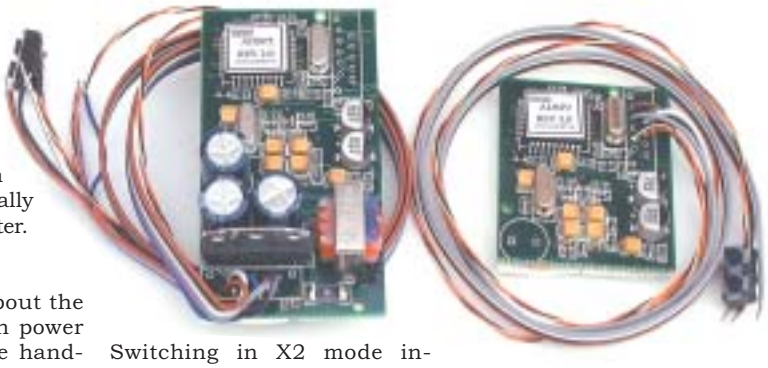
Loudspeaker



The high-power (left) and low-power ADSP^2 boards.

page installation booklet accompanies the boards, but unfortunately there were errors in the 'high power' booklet. The inputs and outputs were sometimes reversed, one section of the booklet was hand-corrected to reflect this but the rest of the wiring information gave conflicting instructions. By the time this appears in print it should have been corrected. The low power instructions were, however, entirely correct and very easy to follow. A tiny circuit diagram on a separate sheet accompanied each booklet, but you'll probably need to use a magnifying glass to read the diagram, which incidentally doesn't show the input and output connection pin numbers.

For internal fitting, each board comes ready-supplied with a self-adhesive foam pad so it can be easily fixed to a panel inside your radio. Although the 'low power' board would normally be my choice, I didn't want to start modifying my radio internally (we reviewers don't get to keep the equipment we test!), so instead I wired the 'high power' board with a 3.5mm jack plug and socket, and tested this in series with my external speaker.

A point to note with the 'high power' board is that the speaker output is balanced, ie neither of the two speaker output wires from the board must be grounded. This means that it really does need to be wired to the speaker wires themselves, and not prior to an external speaker jack socket on your radio which is normally grounded to chassis on the outer.

ON THE AIR

Despite my initial worries about the wiring instructions, the high power board worked first time; the hand-modified table in the booklet giving the correct information. And very well it worked too! I tested the DSP on a variety of bands, modes and interference conditions; in all cases with at least some improvement. In one or two cases, specifically on CW in crowded band conditions, after careful receiver tuning it made the difference between virtually zero readability to absolutely 100% copy, with no other interfering signals audible from the speaker. The three filter bandwidths seemed to be 'brick wall' types, with very steep cut-offs. Even when using the 100Hz filter, there was hardly any trace of 'ringing' on the signal, something I really appreciated. On SSB, in many cases I simply left the 1.8kHz filter switched in permanently, placing the board in 'straight through' mode only occasionally to boost the fidelity on 'ragchew' contacts.

Whenever an interfering heterodyne appears, switching in the 'X1' noise reduction mode nicely notched this, after around a second's delay, to virtual inaudibility. On SSB, I found the X1 mode to be tolerable in noisy band conditions, although it gave received signals a sound like the person was talking with something in their mouth. Switching in X2 mode increased this to a more pronounced 'bubbly' effect, but it still made a real improvement in very noisy band conditions where otherwise the wanted signal would have been even more difficult to understand due to interference. It did, however, often corrupt data signals, so I just used the audio bandwidth filtering in these cases.

A limitation of audio-based DSP is that, if the on-channel interference is stronger than the signal you're trying to receive, your receiver's AGC will cause the wanted signal to reduce in line with the strength of the interference, and no amount of audio filtering will overcome this. But the addition of the DSP filtering, noise reduction, and tone notching can still give your ears an easier time and make copy that much better.

CONCLUSIONS

If you'd like to transform your receiver or transceiver by adding audio-based DSP on receive, fitting one of these boards would, in my opinion, be an ideal addition. Keen CW operators in particular would find their contacts far more enjoyable, and SSB operators who like DX chasing on noisy bands could find their ears get that little bit more of a rest.

Chris Lorek, G4HCL

EDITOR'S NOTE

The low power and the high power DSP boards are each priced **£89.95**. The ADSP^2 loudspeaker is currently available at an introductory price of **£99.95**. Thanks go to Waters and Stanton PLC for the loan of all the review units.

144MHz FM

Naturally enough there was no advantage to be gained from noise reduction when listening to strong stations, but when listening to weak ones the 13dB setting made copy comfortable and removed practically all the smooth background noise with which VHF FM operators are familiar. The remarkable thing was that with very weak stations the 13dB setting made unreadable stations readable. Leaving the squelch of the receiver open produced an interesting effect. When a repeater dropped carrier, the background noise (which was already much reduced in the 13dB setting) gradually faded away as the ADSP2 adapted itself to conditions. The background noise didn't disappear altogether, but I was nonetheless impressed because it meant that as soon as even the weakest station transmitted I heard it.

HF CW AND RTTY

On these narrowband data modes the 26dB setting came into its own. Listening on an HF receiver with a 2.4kHz bandwidth the noise was much reduced on the 13dB setting and all but gone on the 26dB setting. Moreover, heterodynes were removed without any apparent ill effect on the keyed tones of RTTY or on CW signals (unless there was a period of blank carrier which exceeded about a second, in which case the electronics took it to be a heterodyne and filtered it out).

In all tests the ADSP2's speaker produced good communication quality audio. It never rattled.

SHORTCOMINGS

Whilst testing, I identified some aspects of possible improvement.

1. The positioning of the press button – in the middle of the top of the case – is great if you place the speaker on a flat surface or mount it above the support bracket. However, if you want to 'hang' the speaker below the bracket, as you might need to in a car, you can't reach the button. Of course you can mount the speaker upside-down, but it doesn't look as good with the front panel legend the wrong way up (and it didn't seem possible to remove and re-fit it).
2. With such a useful reduction of noise, I was left to wonder how much better the ADSP2 would have sounded through headphones. Shame there's no socket.
3. The speaker needs to be permanently powered. Surely it wouldn't have been too expensive to include a relay to bypass the electronics when power is absent?
4. When power is removed and restored the unit defaults to 0dB noise reduction. In my opinion it would have been better if it could have memorised and returned to its previous setting.
5. A fuse in the power lead would be a worthwhile addition.

CONCLUSION

The ADSP2 operated faultlessly. The 13dB setting invariably reduced background noise and improved the intelligibility of many signals. The 26dB setting needs to be used sparingly on SSB, AM and FM, but was effective on data modes. I was particularly impressed with its ability to act as a 'whistle-killer' whilst receiving CW and RTTY.

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