CQ Reviews: The Heathkit HR-1680 Receiver

BY HUGH R. PAUL*, W6POK

Someone once said that what this country needed was a good nickel cigar. I have said for a long time that what the amateur radio operators of this country need is a good amateur band receiver at a price almost every new amateur could afford. The trend to transceivers has resulted in the near demise of commercial receiver production. Those available on the market start at about $500 and go up. The current increase in the amateur population is quickly drying up the supply of good used amateur receivers. Any of the older breeds that are in good condition are going for a minimum of from $150 to $200. Those who have considered building their own receivers often become discouraged when they discover how costly parts have become. What's a fellow to do?

Heathkit recently announced their HR-1680 solid state, amateur band only receiver at a price of about $200. When I read the specs I began to get interested. Could this be amateur radio's nickel cigar? After having built one, tested it and operated with it, I can say "yes."

The HR-1680 covers 80 through 10 Meters with the exception of that portion of 10 Meters above 29 MHz. It operates from 117 v.a.c., 220 v.a.c. or 11.5 to 15 v.d.c. It offers switch selection of upper or lower sideband and c.w. In the c.w. mode an active audio filter may be switched in to provide selectivity rivaling that of a good crystal filter.

Other features include a good 100 kHz crystal calibrator, a provision for external muting control and injection of a sidetone for c.w. monitoring.

The cabinet and front panel design is similar to the HW-104 transceiver. The dial and S meter glow red when the receiver is turned on, but are nearly invisible behind the dark decorative face plate when the receiver is turned off.

The HR-1680 is a dual conversion design employing twenty one transistors, four IC's and 38 diodes. Construction is on four main circuit boards of good quality, with parts identification silk screened on the top of each board. The v.f.o. board is visible in the lower left corner of the interior photograph. The other boards, from bottom to top, are the front end, heterodyne frequency oscillator/crystal calibrator and the audio amplifier/voltage regulator.

The r.f. amplifier and 1st and 2nd mixer stages employ dual gate field effect transistors. The first i.f. consists of a band pass filter, which passes 8.395 MHz to 8.895 MHz. This filter consists of three sections, with trimmer adjustments on the first and last sections. All of the tuned circuits in the front end of the receiver are diode switched as are the crystals and tuned circuits in the heterodyne frequency oscillator. The result of this design approach is twofold. It reduces the band switch assembly to a single wafer and eliminates the stray capacity and inductance problems that normally result from wiring the tuned circuits to a multiwater band switch. This is important in a kit receiver if uniform performance standards are to be achieved regard-

Front view of the Heathkit HR-1680 receiver. (Photo by Sandra K. Paul.)

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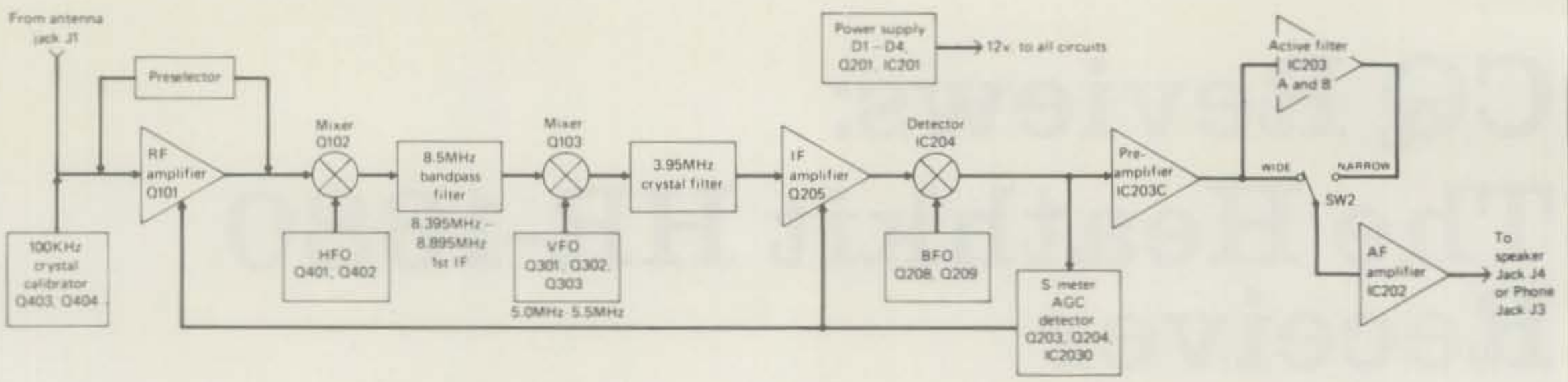


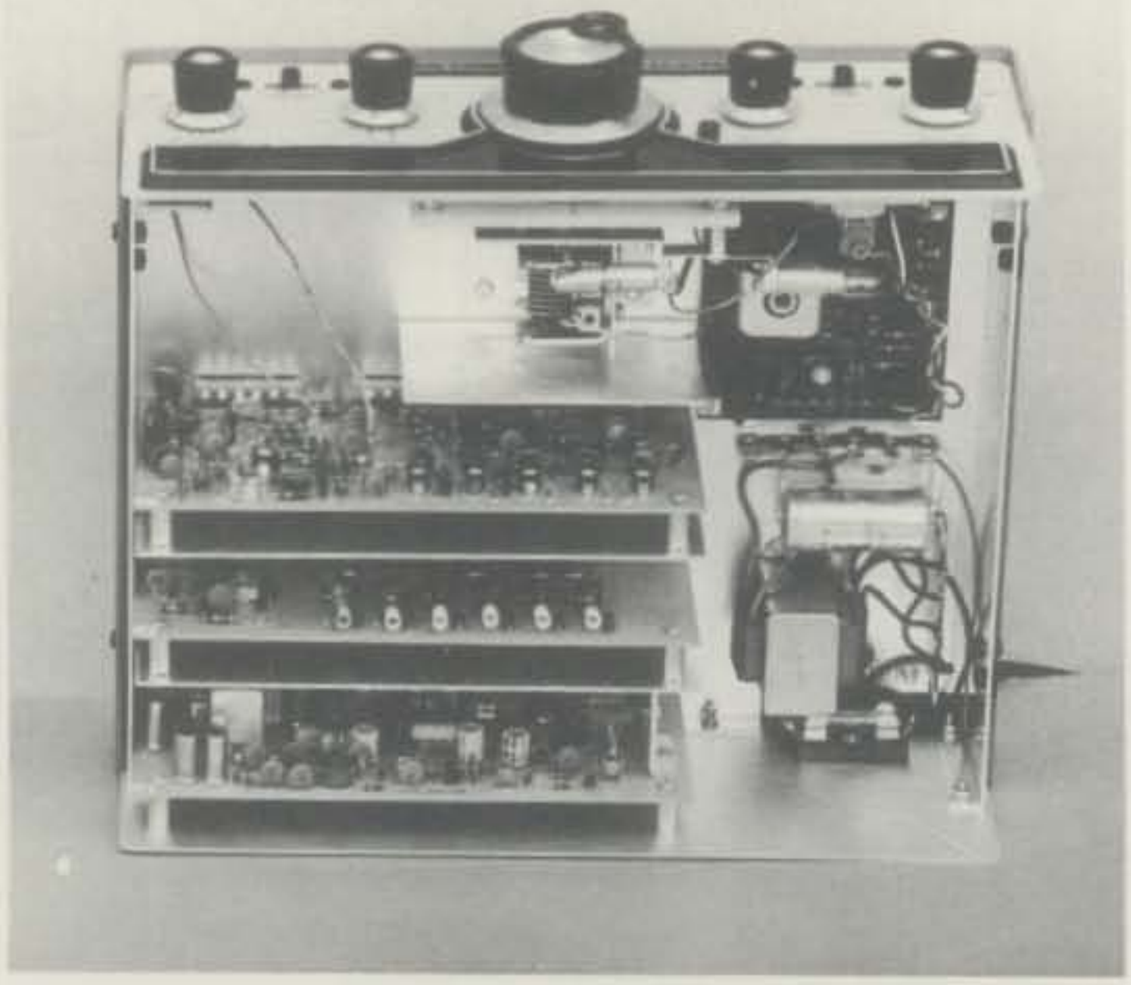
Fig. 1—Block diagram of the Heathkit HR-1680 receiver.

less of the experience of the kit builder.

The v.f.o. tunes from 5 MHz to 5.5 MHz and is injected at the second mixer. The resulting i.f. frequency is 3.395 MHz. Stability and linearity of the v.f.o. is excellent. Extra care in alignment of the v.f.o. resulted in a tracking error across each band of less than 2.5 kHz. The dial readout is calibrated in 5 kHz segments and Heathkit claims a readout accuracy of better than 2 kHz across any 100 kHz band segment, when calibrated at the nearest 100 kHz point on the band. I found I could interpolate to within 1 kHz over any 100 kHz segment after calibration at the nearest 100 kHz point.

Selectivity in the second i.f. is determined by a four pole crystal filter with a published specification of a minimum bandwidth of 2.1 kHz at 6 db down and 7 kHz maximum at 60 db down. The shape factor of the filter in the receiver I built proved to be very close to the published specs.

Selection of upper or lower sideband is by means of a slide switch labeled "Mode". This switch determines which of the beat frequency oscillators is in use. Each oscillator is crystal controlled and very accurate as to frequency.



Top view of the receiver showing the open construction. (Photo by Sandra K. Paul)

A.g.c. is audio derived and is applied to the r.f. amplifier and the 3.395 MHz i.f. amplifier stages The release time constant in the fast mode is 100 microseconds. In the slow mode it is 1 second. Attack time for either mode is less than 1 millisecond. On very strong signals the a.g.c. needs a little help from the r.f. gain control if some distortion is to be avoided. This is not to imply that the front end overload characteristics are poor. Strong local signals immediately adjacent to the receiver passband create only minimal intermodulation. There is no de-sensing or a.g.c. pumping as a result of these strong adjacent signals.

One of the outstanding features of the HR-1680 is the two stage active audio filter, which can be selected by the function switch. When the output from the audio preamp is routed through the filter to the audio power amplifier, the audio response is narrowed to a minimum of 250 Hz at 6 db down and a maximum of 7 kHz at 60 db down. The result is single signal c.w. copy that rivals the quality you would expect with a good crystal filter.

When the receiver is tuned so that the frequency of the c.w. beat note falls within the passband of the audio filter (750 Hz), there is absolutely no change in signal level when switching the filter in and out. No crystal filter can make that claim.

The IC audio amplifier supplies about 2 watts of audio into an eight ohm load, at less than 10% total harmonic distortion. Audio quality is excellent and there is plenty of it.

Heathkit rates the sensitivity of the HR-1680 at less than .5 microvolt for a 10 db signal-plus- noise to noise ratio. Testing showed that this figure was not optimistic. Sensitivity was .5 microvolt or better, depending on the band.

Image rejection is better than the 50 db claimed as is the i.f. rejection figure of 60 db. The latter is achieved with the help of two traps for 8.5 MHz and 3.395 MHz, located in the front end. A third filter

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seven — W6QGX and W5RZJ. (W6CEE and W3PVH had made them all through the 6th.) And can you imagine, for all times for it to happen, your reporter was suffering from a severe case of laryngitis!

At Saturday's business meeting the matter was brought up of the site for the next YLRL convention. No invitations had been received, but WB2YBA, Chris, thought there might be a possibility of the N.Y.-N.J. area. Your reporter would like to suggest that the eighth YLRL convention be held in 3 years, in 1979, rather than in 4 years, so that it would coincide with YLRL's 40th anniversary! The only areas in which we have not met are the southwest and the northwest. How about it, gals? ■

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prior to the r.f. amplifier attenuates signals above 30 MHz.

A two section ganged variable capacitor is used as the preselector tuning. One section is connected across Gate 1 of the r.f. amplifier transistor and the other section is across the drain. Lead placement from the variable to the circuit board is critical in order to achieve proper tracking between the two sections of the capacitor. If you follow the assembly instructions carefully there should be no problem.

The stability of the HR-1680 is outstanding. Heathkit claims that drift will be less than 100 Hz per hour after 30 minutes warmup. I found that drift was less than 60 Hz. You can bang on the receiver, pick it up and turn it over, even raise it three inches off the desk and drop it, but the frequency will not shift. Absolutely great in this respect.

The dial drive mechanism must be given credit for its contribution to the stability of the receiver while subject to mechanical stress. It is simple and yet unique in its design. Two Jackson Brothers verniers are connected in tandem. The first one is mounted on the front panel and the second one on the v.f.o. tuning capacitor sub-assembly. The result is the most rigid dial tuning mechanism to be found on any of the current crop of receivers or transceivers on the amateur market.

The large spinner type tuning knob provides easy, fatigue-free tuning over extended periods of time. One revolution tunes approximately 15 kHz. Heathkit claims less than 50 Hertz of backlash in the dial drive mechanism. If you are careful about alignment during assembly, you won't detect any backlash.

Assembly of the HR-1680 is simple enough for a beginner to put together and be sure of achieving good results. When the receiver was first turned on, I heard signals. Alignment is easy without any test gear because of careful kit design and the use of many fixed tuned circuits employing toroid coils. Rough alignment of coils requiring tuning has obviously been done at the factory, thus minimizing such problems as getting oscillators to oscillate, et. About five evenings should be allowed for construction of the kit.

While the experienced operator can think of additional features that are desirable, don't think for a minute that the HR-1680 is a "beginner's" receiver. It is capable of really good c.w. and s.s.b. performance on today's crowded bands. In my opinion it is the "best buy" that Heathkit has ever offered in a receiver, giving consideration to performance versus cost. ■

Modular Amplifier *(from page 29)*

sorted out on L1, which had 22 turns. The amplifier current increased to 400 ma at resonance. The three shorted turns were removed from L1, however, the photo in fig. 5 shows the coil before modification. The bias was set to −10 v.d.c. which results in an idling current of 25 ma. This is done by pressing the mike switch, which applies the high voltage with no excitation applied to the amplifier input (assuming it is quiet and the carrier balance is nulled). The output was then coupled to an oscilloscope and the normal s.s.b. waveform was displayed. No flattopping could be observed.

I am satisfied with the performance of the two small units as well as their appearance. Peak currents are slightly over 400 ma. for a power input of 500 watts. If more power is desired, a voltage tripler could be tried. ■