RADCOM EQUIPMENT REVIEW

The Howes DXR20 Receiver Kit

Reviewed by Chris McWhinnie, G0MQW

THE HOWES DXR20 kit is an SSB and CW receiver which covers the 20, 40 and 80m bands, plus any other HF frequency band with an optional plug-in module. The receiver is made up of three separate kits: the DXR20 receiver kit itself, the HA20R hardware pack, which includes the case, and the DCS2 S-meter kit. The Howes catalogue states that the S-meter is an 'optional kit', but the hole is already cut in the front of the HA20R chassis and the completed receiver would look fairly odd without the meter. The kits arrived in excellent condition, protected by bubble wrap and curly polystyrene bits. All the components and the hardware for each kit were in polythene bags inside sturdy boxes.

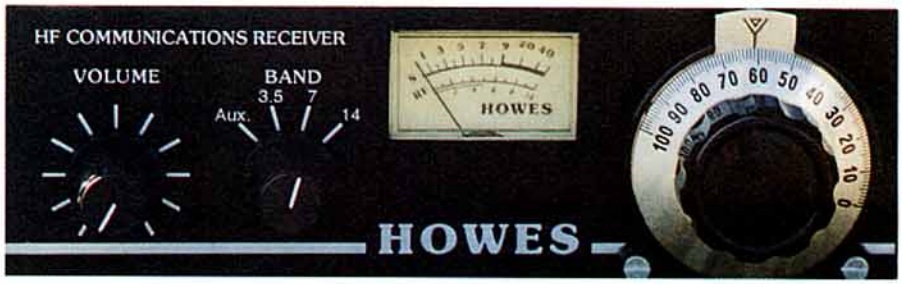
PREPARATION

SPENDING TIME READING the instructions is the most essential preparation for constructing this kit. The DXR20 instructions have a more up-to-date look than those of some earlier Howes kits. The art work is improved and the clear font is much easier to read when constructing. A brief technical description of the receiver reveals that it is of the 'direct conversion' type and that it is possible to cover 1.8 - 30MHz with the appropriate additional modules. There is a full circuit diagram, and explanations of the design. The 'notes on soldering' are essential reading for less experienced constructors, and a good reminder to everyone else. The instructions state quite clearly that a soldering iron of about 25W with a small tip is required, as are small side cutters, long-nosed pliers and a trimming tool. Most kit builders possess the cutters and pliers. However, the trimming tool for the can-type coils may be difficult to obtain, and as many constructors have learnt to their cost it is just not worth taking the risk of using a metal screwdriver. A test meter and a de-soldering pump for that inevitable mistake would have been useful additions to the list.

PCB CONSTRUCTION

FOLLOWING HOWES' notes in order, the first parts to be fitted are the terminal pins, for external connections. These needed some pressure applied with a hot soldering iron to push them through. This can be slightly hazardous, as the iron is inclined to slip and the tip of the iron was bent slightly during this procedure.

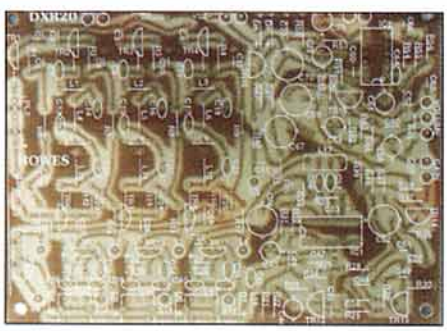
Next came the 56 resistors, which are listed very neatly on the page, fortunately with all the colour bands. A pencil is essential here for marking the list as each resistor is fitted.



The instructions suggest soldering each resistor as it is fitted, although fitting all the resistors first and then soldering them may make it easier to correct any mistakes before soldering. This took exactly an hour, including the soldering, using a natural light bulb, although daylight would have made the job a little quicker. The clear white markings on the PCB and sensible numbering of the resistors helped to locate most holes quickly, although a few were rather elusive.

The 13 axial inductors came next. The body of one was broken by pulling too hard with pliers, but it still worked. Then came the seven diodes and 74 capacitors. The instructions clearly identify which way round the components that have polarity need to be fitted. These notes would be better placed chronologically in the text than in the later parts list. All this took another two hours.

Transistors and ICs were then fitted. Eight of them need their emitter lead removing close to their plastic bodies, as they are being used as switching elements for the RF filters instead of diodes. This was a bit fiddly, and caused some concern that the collector leads which needed to be bent at 90° would snap, although none of them did. Both IC 'chips' also needed the pins bending inwards to fit the PCB. Three coils in screening-cans were fitted next. One was a bit stubborn, as the PCB hole was just slightly too small. That was another one and a half hours.



The main DXR20 printed circuit board.

The most fiddly part of the kit was the mixer input transformer, which needed to be wound on a two-hole balun core. Six turns of blue wire and two turns of yellow wire on the top sounds easy, and so it was until the wires were cut and the ends of the very thin wire stripped of insulation by melting with the soldering iron. It was a struggle to get the four thin wires into the right holes and keep them there long enough to solder them. One wire was a bit short as the coil pulled through but the continuity was tested with a meter and found to be OK. By the time the last components - two six-pin plugs for the optional plug-in frequency ranges - were fitted, another two hours and twenty minutes had elapsed, albeit quite enjoyably.

At this stage a very neat PCB with lots of shiny components and mainly shiny soldering joints was completed. The board's white markings still showed for trouble-shooting and the board was thin enough to hold up to the light to spot unsoldered components and to show up any solder bridges.

HR20R HARDWARE PACK

THE HR20R HARDWARE kit includes a chassis with removable plastic protection and a front panel covering already stuck on, all the knobs, screws and nuts, an 8:1 'vernier dial', the SO239 aerial socket, a 50pF variable capacitor and a set of instructions. A medium cut flat file, a screwdriver and spanner for M3 nuts and bolts and a number of drills were listed as necessary tools for working on the hardware kit. A centre punch is also almost essential, as it is very easy to miss felt-tip marks.

The corners at the back of the base needed rounding off as per instructions, hence the file. Holes needed to be drilled in the base, sides, back and capacitor-mounting bracket.

The small mounting bracket for the variable capacitor needed fitting along with the geared dial which is marked 0 - 100. It is described as 'vernier' and the Japanese design is very neat, but does not have a vernier

scale. The bracket, dial and capacitor needed fitting carefully to make the tuning movement as smooth and light as possible.

THE BOARDS

THE BOARDS ARE supposed to be spaced off the chassis by an M3 nut, but only the most neatly-soldered board could get away with just one nut spacing. The M3 nuts are only a few mm thick and finger pressure on the PCB was enough to ground some of the more artistic soldering joints on to the base. A second nut was therefore added at each corner to provide more spacing. Once the knobs, controls and sockets were installed it was time to wire in the board. Another two and a quarter hours had passed.

Connections to the band-switch, the volume control, and audio output were soldered using the terminal pins. 22SWG tinned copper wire was provided for wiring the capacitor and band-switch and thin co-axial cable for the aerial input. No power lead is provided at all and the inclusion of a fused DC power lead with a matching DC socket would be a welcome addition to the kit.

The HR20R hardware kit and DXR20 PCB and components.

TESTING

A SMALL BATTERY was used for testing the receiver, rather than testing for smoke with a 20A power supply. Headphones were plugged in and power applied. There was a click and a hiss and nothing happened.

The instructions listed seven very sensible suggestions in the case of a non-functioning receiver. The connection of an aerial had been overlooked, but there was still nothing. The band-switch and the aerial input leads were waggled. When the volume control terminal pins were touched, the set sprang into life. The potentiometer had no effect and another waggle established that it was connected the wrong way round and that the three terminal pins all had intermittent connections. They had been overlooked when soldering, as had the aerial pins, but being at the edge of the board this was easily fixed.

DCS2 S-METER ACCESSORY BOARD

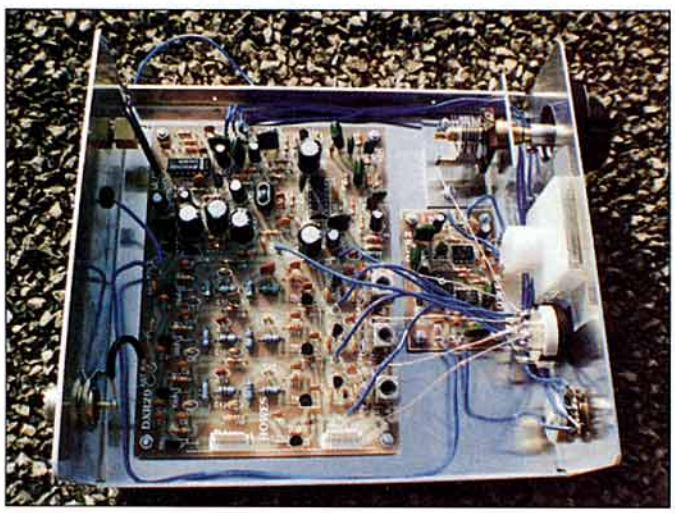
THE S-METER driver, on a second small PCB, took only half an hour to position the components and solder, but it also did not work when it was switched on. Two of the three diodes had been placed the wrong way round, due to being in a rush when wiring up and soldering. It was rather fiddly to remove the PCB from under the front band-switch wiring.

Although the instructions suggest that the receiver should be installed and tested first, I would suggest fitting the DCS2 meter circuit at the same time as the receiver board, but leaving it de-powered. The unit can also indicate relative RF voltage in combination with a low power transmitter.

ALIGNMENT

THERE WAS NO trimming tool supplied, which is an omission. A search through the junk box found a selection of seven, none of which fitted the tiny slot in the three ferrite cores, so a small plastic trimming tool had to be cut down to fit.

Listening to each band suggested that the 80m range was probably above or below the required band, that the 40m range was probably below 7MHz and that the 14MHz band either needed drastic re-aligning or no signals were propagating.



Inside view of completed DXR20 receiver.

It was noted in the instructions that the cores need to move by between 2.5 and 5mm below the can tops. Knowing that a direct conversion receiver has an oscillator at the received frequency, the aerial of the DXR20 was connected to the RF input of a communications receiver and switched to CW. A few turns of the cores took them to the requisite depth and produced healthy whistles. The dial was set to '0' at a few hundred Hz below 3,500, 7,000 and 14,000kHz. The 20m coil was, by nature of the higher frequency, the most difficult to set precisely.

Not everyone will have another receiver for aligning the three coils. The mechanical method of measuring the core depth worked fine for the lower frequencies but I was over 120kHz out in frequency at 20m using that method.

CIRCUIT DESCRIPTION

AN 8-POLE band-pass filter for each band reduces unwanted signals. Switching diodes are used to isolate the required sections. In common with all direct conversion receivers the RF signal is combined in a mixer circuit with an on-board RF oscillator to produce a audio signal, ie an incoming signal at 3600kHz and the VFO set at 3601 or 3599kHz would produce a 1kHz CW note. An SSB transmission would need the receiver's VFO to be tuned to a frequency close to that of the missing carrier.

Audio frequency amplification is followed by audio filtering followed by more amplification up to 1W maximum, which is more than sufficient for a loudspeaker or headphones. The S-meter circuit is driven by the audio stage of the receiver. Two operational amplifiers produce the output to the meter.

PERFORMANCE

THE ACTUAL tuning ranges obtained were:

Dial 0 = 3500kHz, 92 = 3800kHz, 100 = 3810kHz

Dial 0 = 7000kHz, 63 = 7100kHz, 100 = 7175kHz

Dial 0 = 14000kHz, 67 = 14350 kHz, 100 = 14541kHz

The DXR20 was compared with a Sony 2001D portable and the JRC NRD-535 communications receiver. It seemed unfair to compare the DXR20 with the NRD-535 but once it had borne comparison with the Sony synthesised portable and whip aerial, it was only with the use of the additional IF filtering of the JRC receiver - at 20 times the cost - that

I could appreciably improve on the readability of signals from the Howes receiver. A short 5m length of wire or a Howes AA2 HF active aerial was used for all the tests.

The wide-open feel of 80m in particular was refreshing to hear after years of the AGC-bound confines of commercial designs. Noise from the active aerial was far more of a factor than any produced by the RF or AF circuit of this receiver. There was no sign of the breakthrough due to the first harmonic of the oscillator from 40m signals, despite the warning in the text.

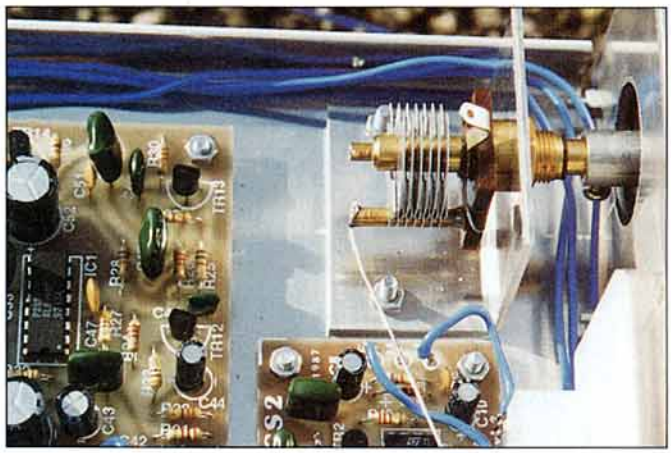
The 40m band appeared to be less sensitive than expected, but this was probably a bonus in the presence of the 41m band broadcasters while the band was in poor shape. The perceived quality of SSB demodulation when signals were well spaced in frequency was better than the Sony portable and the JRC radio.

The 20m band was a disappointment, although not in terms of sensitivity, which was ample. Even with 8:1 tuning reduction gearing in the dial, the wide 540kHz tuning spread make SSB or CW tuning very tricky for those used to commercial communication receivers, although it can probably be mastered with some practice. The range should be reduced and experimentation with the capacitors on the 14MHz oscillator may achieve this.

There was no discernible tuning backlash. The oscillator was stable for all normal purposes, but not recommended for AM demodulation. Stability is aided by the solid case design, voltage stabilisation and stiff wiring.

OVERALL

CONSIDERING THE relatively few components required and the small number of active ones, this receiver gives a very creditable performance and would suit a novice, QRP operator or traveller wanting a small receiver for the most popular amateur bands. The aerial requirement is minimal and the case is very presentable, looking like a commercial product. The S-meter and the box are almost essential, so much so that all three kits should be available as one package with combined instructions, in preference to cross-referencing.



Detail of the main tuning capacitor and DCS2 S-Meter board.

This is an easy route to good amateur band performance at a low financial cost. The dependable results, fine design, ease of construction, layout of the board and written instructions are all in this kit's favour. The overall time to take the receiver from a box of bits to a fully working state was eleven hours, or roughly five enjoyable evenings of work for any grade of radio hobbyist.

The people at Howes sounded very friendly on the phone when I needed the S-meter kit sent to me. They can help with advice, or if you get in too much technical trouble they can intervene for a modest fee.

COST

THE HOWES DXR20 20 / 40 / 80m receiver costs £39.90 in kit form or £67.90 assembled. The DCS2 S-meter costs £10.90 in kit form or £15.90 assembled. Optional Band Module kits (one can be fitted) for 160m, the 5.45MHz air-band, 30m, 15m or 10m cost £7.90. The HA20R Hardware pack (case etc) costs £28.90. Postage and packing is £1.50 for the electronic kits, £4.00 if hardware is included. A suitable trimming tool, if required, is also available from C M Howes Communications at nominal cost. ♦