

■ Equipment Review

YAESU FT-920 HF and 50 MHz All Mode Transceiver

Reviewed by Ron Fisher VK3OM*



The Yaesu FT-920 transceiver.

The new Yaesu FT-920 is a mid-priced transceiver which slots between the popular FT-1000MP and the FT-900. It is a fully featured rig with everything that the discerning amateur would require. At a selling price of \$2995, a full \$1000 less than the FT-1000MP, I am sure it is destined to be a very popular transceiver. It will no doubt replace the FT-990 which has been around for nearly five years now.

One of the most important new features of the FT-920 is the inclusion of the six metre band and I will be looking at its performance on this band in some detail. As I am not equipped for six metre operation, I enlisted the help of well known six metre identity John Patterson VK3ATQ to pass judgement on the FT-920's performance on the 50 MHz band.

Compared with the earlier FT-990, there are two other important differences. The first is the inclusion of full digital signal processing (DSP) for both transmit and receive; and the other is the omission of a built-in AC power supply. In view of the fact that the FT-920 is actually larger than the older FT-990, this is surprising. The FT-920 therefore

requires an external 13.8 volt DC power supply capable of supplying 22 amps. The Dick Smith D3800 would be an ideal choice and, in fact, one of these was used for all of my tests.

There is no doubt that the design of the FT-920 is based to a large extent on the highly successful FT-1000MP. Stand back a few metres and one could easily be mistaken for the other. However, the second tuning control is not for a second receiver but for the second VFO. For those who don't require a second receiver this, as I will explain later, is an excellent alternative. The second tuning control is also used for RIT/XIT and menu selection.

FT-920 Features and Facilities

The FT-920 is a large transceiver. The front panel is the same size as the FT-1000MP and the depth of the cabinet is just 30 mm less. The overall dimensions are 410 mm wide, 135 mm high and 316 mm deep. It weighs in at 11.5 kg, somewhat less than the 15 kg of the FT-1000MP due to the omission of the AC power supply, but still hefty enough

when you need to carry it around.

The dominant feature of the front panel is the "Omni Glow" display. The bright orange background contrasts with the black lettering to produce a very readable display. This has a multitude of information to convey to the operator. I feel that it is superior to the FT-1000MP display which, under certain external lighting conditions, produced an annoying shadow effect. No doubt the FT-1000MP is more showy, but the FT-920 display is more effective.

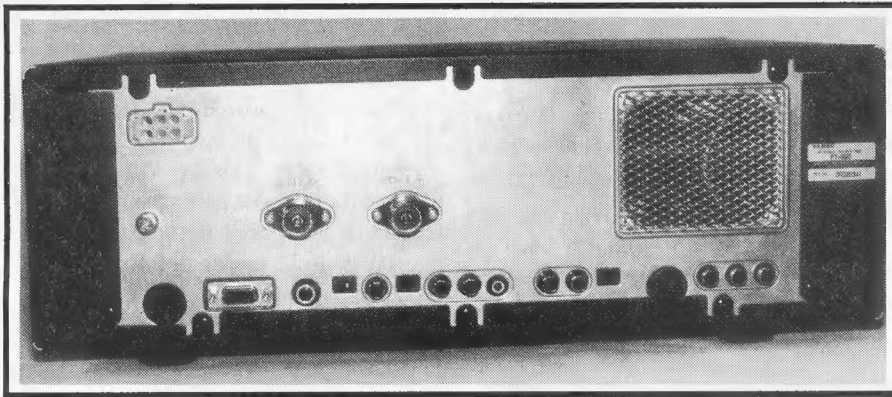
In addition to the "S" meter function, the bar-graph metering has many additional functions. These include power output, ALC, SWR, DC voltage, compression and PA current. All have a "peak hold" function which can be programmed via the menu. Up to three of the above metering functions can be viewed at the same time.

All modes of operation are provided, including FM which I note is only offered as an option in 920s sold overseas. Perhaps the only mode that is not fully catered for is AM. The only AM reception offered is through the standard SSB filter which, of course, sounds restricted. A six kHz filter is offered as an option and this should produce acceptable AM quality.

A medium selectivity CW filter (500 Hz) is available. No optional filters were included in our review transceiver. Several data modes are included with various shifts selectable.

Receiver coverage is from 100 kHz to 30 MHz, and then from 48 to 56 MHz. Unfortunately, there is no receiver coverage between 30 and 48 MHz, which will disappoint keen six metre operators who like to keep an ear on this part of the spectrum.

Transmitter coverage is confined to the various amateur bands. Each band is selectable via a dedicated "band" button and each of these buttons can recall two different frequencies. The same key pad can also be used to enter any frequency directly if required. However, the tuning controls set the FT-920 apart from other transceivers. As mentioned before, the second tuning control is for VFO B. The big difference is that while you can only transmit or receive on one of the two VFOs, they are adjustable independently at the same time.



The rear panel of the FT-920.

Let's say you are listening and transmitting on 14.2 MHz using VFO A and you want to check a DXpedition on 14.250 MHz. Tune VFO B to that frequency and, when ready, push the "RX" button above VFO B and there you are. With a quick push of the "RX" button above either VFO you can check either frequency. The big advantage over the old VFO A/B system is that the other VFO is fully adjustable while using the first. Perhaps not quite as good as a second receiver, but certainly way ahead of older transceivers.

The main tuning control is a delight to use with three selectable tuning steps which give 1, 10 or 100 kHz per knob revolution at tuning steps of 1, 10 or 100 Hz. Carried over from the FT-1000MP is the wonderful "shuttle-jog-tuning" system. This is the large concentric control behind the main tuning control. It is spring loaded from the centre position. As it is turned either left or right the tuning starts up or down with the scan speed increasing the further the knob is held over. Its a great way to zip up and down the band.

Naturally, the FT-920 has a built in automatic antenna tuner. It is capable of matching up to a 3:1 SWR on the HF bands and a 2:1 SWR on the six metre band, and can selected for both transmitter output and receiver input. The ATU has its own memory system with 100 channels. Tuning is very quick, usually under two seconds.

The FT-920 bristles with additional features and I will give a brief mention of some of them. The most important of these is the digital signal processing (DSP). All of the processing takes place

at audio frequencies and not, as is often the case these days, at a very low IF frequency. There are advantages and disadvantages for the audio system, but Yaesu have introduced one of the most advanced audio DSP systems available and it works very well.

There are four main DSP functions available. These are receiver noise reduction, receiver automatic notch filter, dual control receiver passband tuning which gives independent control over high and low frequency cut, and finally tailoring of the transmitted audio band pass characteristics. The DSP also has other functions which include control of the transmitter voice operation to give faster response compared to the more usual analogue systems.

The FT-920 has a built in digital voice recorder which is available to record "CQ contest" type messages. It can also

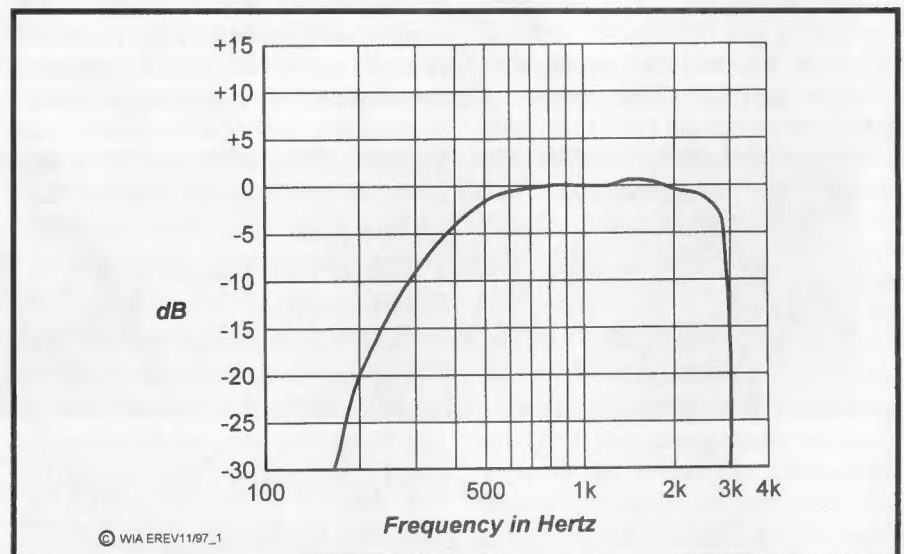
be used on receive to record incoming signals for later reference and can actually be left running continuously so that the last 16 seconds can be replayed when required.

To back up the DSP noise reduction is a fully adjustable noise blanker, and to back up the DSP passband tuning is an effective IF shift control. For the CW enthusiast, there is a built-in electronic keyer with a speed adjustment from six to 60 words per minute, plus a contest message memory system. Up to six messages can be stored, four of which can contain up to 50 characters, and two containing 20 characters.

The menu contains some 73 programmable functions. Probably most of these will not require changing, but a new owner will have lots of fun going through them. Keep your instruction book handy so you can access the menu function you need quickly. Yaesu have thoughtfully included a "quick menu" facility to allow you get to the most needed items without delay.

FT-920 On Air

First connect your power supply. As mentioned earlier, I used a Dick Smith D-3800 power supply for all of my on-air tests. I note that Yaesu do produce a matching external supply for the FT-920, the FP-1030A, which has a noticeable resemblance to the Dick Smith supply. I doubt that we will see the Yaesu supply in Australia as the Dick Smith organisation



The FT-920 transmit audio response on 14.2 MHz with no compression and no ALC.



Top view of the FT-920 with the case removed. Note the cooling fan at the left between the front panel and the HF PA board. The ATU is beneath the metal shield to the rear right.

seems reluctant to import Yaesu power supplies unless they happen to be part of the equipment. The FT-920 is supplied with a heavy duty DC cable fitted with two plug-in plastic automotive-type fuses. A standard six pin DC connector is used to connect to the radio.

On initial switch-on, there is a one second pause while the electronics sort themselves out before the transceiver comes to life. The "Omni Glow" display is the dominant feature, of course. The brightness of this can be set to two intensities. I preferred the brightest setting.

Received audio quality through the internal 7.5 cm speaker was excellent. So much so, that I did not find it necessary to connect an external speaker. For permanent installation, though, a forward-facing good quality speaker could be desirable. Tuning around the amateur bands I was struck with just how clean the audio sounded. The high and low cut filters are very effective and, I must admit, better than I had expected. However, they do have their limitations as, of course, they only remove the effect and not the cause. The same can be said of the notch filter which can remove an offending heterodyne like magic, but cannot eliminate the blocking effect of a close strong signal.

Compared to the FT-1000MP, the overall selectivity is wider and doesn't have the same ability to eliminate interfering signals. There was indeed a good reason for including the Collins filter in the FT-1000MP!

The DSP noise reduction control gives 32 positions of adjustment so you can fine-tune the amount required. Again, I found that for SSB reception I could not find a situation where the DSP could produce a readable signal from an audible but unreadable signal. The single position adjustable noise blanker was very effective eliminating impulse noise and, to a slightly lesser extent, power line noise.

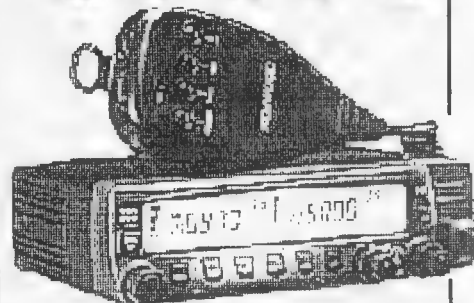
The AGC action was very smooth with the slow decay selected. You have the choice of fast, slow or off. Yes, you can actually switch the AGC off on the FT-920. I am sure this will please many operators.

One very interesting feature of the FT-920 is the use of single control knobs. The only concentric controls are the high/low cut knobs and the shuttle jog control behind the main tuning knob. If you happen to have five thumbs on each hand (some of us do), you will appreciate this feature.

The FT-920 is supplied with a Yaesu MH-31B8 hand microphone. This rather ordinary looking microphone does seem


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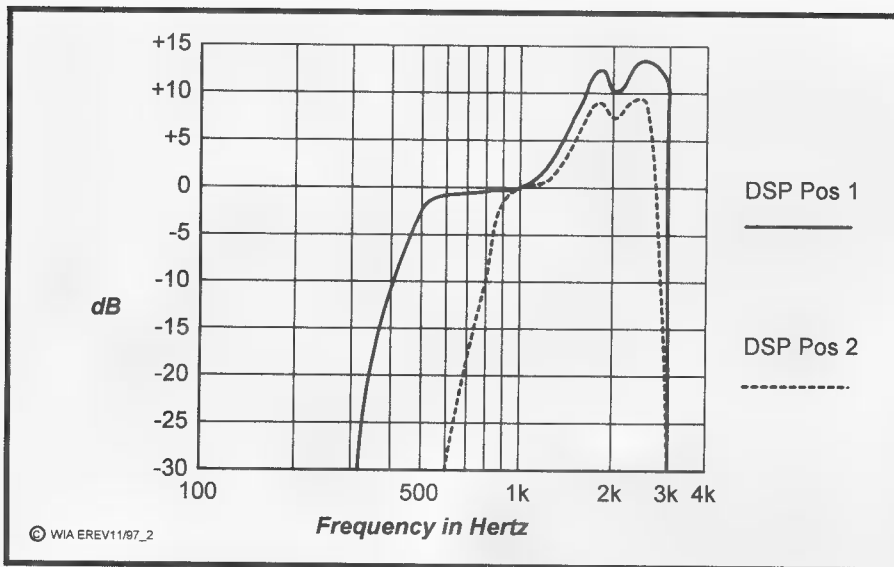
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The FT-920 transmit audio response on 14.2 MHz with DSP switched to position 1 and position 2.

to have better than usual audio quality. The up/down buttons are on the front of the microphone and I found them rather hard to get at. In particular, if you need to use the "fast" button in conjunction with one of the other buttons, I found it required two hands, or at least a finger from each hand.

Reports on the transmitted audio were very favourable but, in general, the audio with the DSP selected was not liked. It was at this point I struck a problem. Try as I might, I could not get any sense out of the speech processor. The compression level as shown on the bar graph display would not exceed 5 dB, even with the compression control set full on. I feel this could be an isolated fault in this particular transceiver. As we will see later on, this limited the six metre performance to a very marked extent.

During the bench testing I found that the transceiver runs very very cool. The cooling fan is quiet in operation and is thermostatically controlled. At no time did the transceiver get more than lukewarm.

FT-920 On Test

First off, the transmitter power output and current drain were measured in the CW mode with 13.8 volts DC applied to the supplied DC power cable. The following results were obtained:

Band	Power Out	Current Drain
1.8 MHz	110 watts	18.0 amps
3.6 MHz	110 watts	17.5 amps

7.1 MHz	106 watts	16.5 amps
10.1 MHz	105 watts	18.0 amps
14.2 MHz	105 watts	16.5 amps
18.1 MHz	100 watts	17.0 amps
21.1 MHz	100 watts	17.5 amps
24.5 MHz	100 watts	19.0 amps
28.5 MHz	100 watts	18.0 amps
29.5 MHz	100 watts	20.0 amps
50.5 MHz	100 watts	22.0 amps

PEP output on SSB was checked on a scope under two tone conditions and found to be exactly the same, which probably says more for the power supply than the transceiver. Minimum power output, with the RF power control backed fully off, was within a whisker of five watts on all bands, which might be a fraction high for the dedicated low power operator.

Perhaps the most interesting feature of the above measurements is the relatively high current drain at 50 MHz for 100 watts output. More on that later.

Next on the list was my usual test to estimate transmitter intermodulation distortion. This was carried out at 14.2 MHz and showed -25 dB relative to 100 watts PEP output. Some quick checks on other bands showed that, while this figure improved slightly on the lower frequency bands, it did not deteriorate to any extent on the higher bands, including six metres.

Finally, power output was checked with the automatic antenna tuner in circuit feeding a 3:1 resistive SWR. On

the lower frequency bands the loss was quite low, averaging around five watts, but on 28 and 50 MHz losses increased to around 20 watts. While this last figure might sound a lot, in practice it only amounts to a small fraction of an "S" point.

The transmitter frequency response tests, as usual, produced some interesting curves. The instruction manual describes the various positions as follows:

1. Mid and high frequency components are enhanced;
2. A high emphasis response is produced, ideal for pile-ups;
3. Both low and high emphasis is produced; and

4. A wide bandpass emulating a broadcast microphone characteristic.

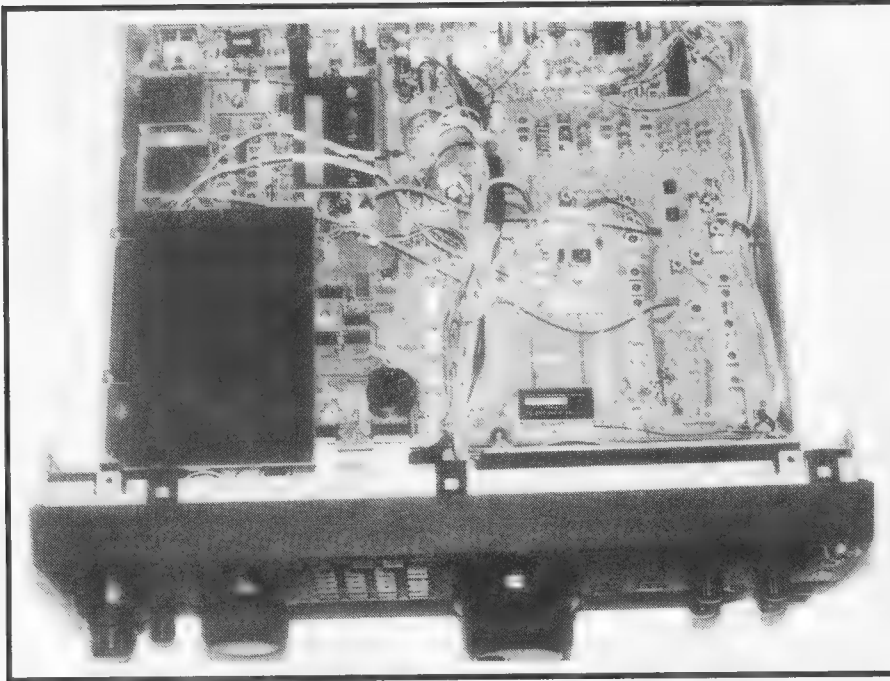
As an ex broadcast man, I cannot quite see this. In practice, use the position that gives you the best reported audio. I found that my best reports were obtained with the DSP switched off.

There are two other means of adjusting the transmit audio available to the user of the FT-920. One is via the menu system, where you can adjust the band pass relative to the filter to give slightly more or less high or low frequency response. Secondly, there is a separate adjustment for both upper and lower sideband. These are available through menu numbers U-59 and U-62.

I also note that the receiver carrier point is adjustable via the menu. An adjustment range of -300 to +500 Hz is provided for both transmit and receive. All of my tests on both transmit and receive were carried out at the default setting with no offset selected, which seemed to produce acceptable results. All SSB tests were carried out using the supplied hand microphone. I would have liked to try the FT-920 with the MD-100A8X microphone. I am sure the results would have been superb.

Receiver Tests

The first receiver test was to check the S meter calibration. The meter is not a meter in the normally accepted sense, but a bar graph as part of the big LCD. Again I have to say that I much prefer a good old-fashioned moving coil meter which gives a much more accurate indication. But, like it or not, it seems unlikely we



Underneath view of the FT-920 with the case removed.

are going to see any more old-fashioned meters.

One of the problems with bar graphs is that the segments come on and off at different signal levels. However, taking all of this into account, these are the figures I recorded:

S Meter Reading	Voltage input at 50 ohms PD
S1	1.7 μ V
S3	2.0 μ V
S5	2.5 μ V
S7	7.0 μ V
S8	10.0 μ V
S9	35.0 μ V
S9+20 dB	800 μ V
S9+40 dB	.01 volt
S9+60 dB	.07 volt

These measurements were taken with the pre-amp switched on.

Each amateur band was then checked in turn to measure the signal input to give an S9 reading:

Band	Signal for S9
1.8 MHz	30 μ V
3.5 MHz	25 μ V
7.0 MHz	30 μ V
10.0 MHz	30 μ V
14.0 MHz	35 μ V
18.1 MHz	35 μ V
21.0 MHz	40 μ V
24.0 MHz	40 μ V
28.5 MHz	42 μ V
29.5 MHz	22 μ V

These figures are very consistent from band to band. They were taken with the pre-amp switched in. The pre-amp averaged about 14 dB gain although this varied slightly across the bands with slightly higher gain at the higher frequencies.

The attenuator has three positions of attenuation, 6, 12 and 18 dB, and these measured spot on. Again, could I appeal for an extra position at 24 dB to give more accurate readings of antenna gain measurements. It seems that all manufacturers have got together and chosen a maximum of 18 dB. Why?

Receiver sensitivity was measured. The measured figures easily bettered the published specification which is 0.2 μ V with pre-amp on, 10 dB S/N ratio up to 24.5 MHz and 0.13 μ V from there up to 54 MHz. My measurements were:

Band	Sensitivity, Pre-amp in
1.8 MHz	0.15 μ V
3.5 MHz	0.15 μ V
7.1 MHz	0.14 μ V
10.1 MHz	0.12 μ V
14.2 MHz	0.15 μ V
18.0 MHz	0.12 μ V
21.0 MHz	0.14 μ V
24.0 MHz	0.1 μ V
28.0 MHz	0.1 μ V
50.0 MHz	0.1 μ V

John VK3ATQ did a measurement at 14 MHz for me for noise figure and minimum discernible signal. These were a NF of 5.5 dB with the pre-amp in with an MDS of -134.5 dBm, and 10.2 dB and -129.8 dBm with the pre-amp out.

Receiver audio measurements were taken with a 4 ohm load connected to the external speaker socket. Specified audio output is 1.5 watts at 10% distortion. Our review transceiver easily exceeded this with 2.6 watts at 10% distortion. At a normal listening level of 0.5 watt, the distortion had dropped to a very creditable 0.6%.

The automatic notch filter has a measured range of 160 Hz to 3.2 kHz and is capable of reducing a heterodyne by a whopping 42 dB. Audio noise level at minimum gain was -62 dBm. Even you young fellows with acute hearing won't have any trouble with hiss or hum!

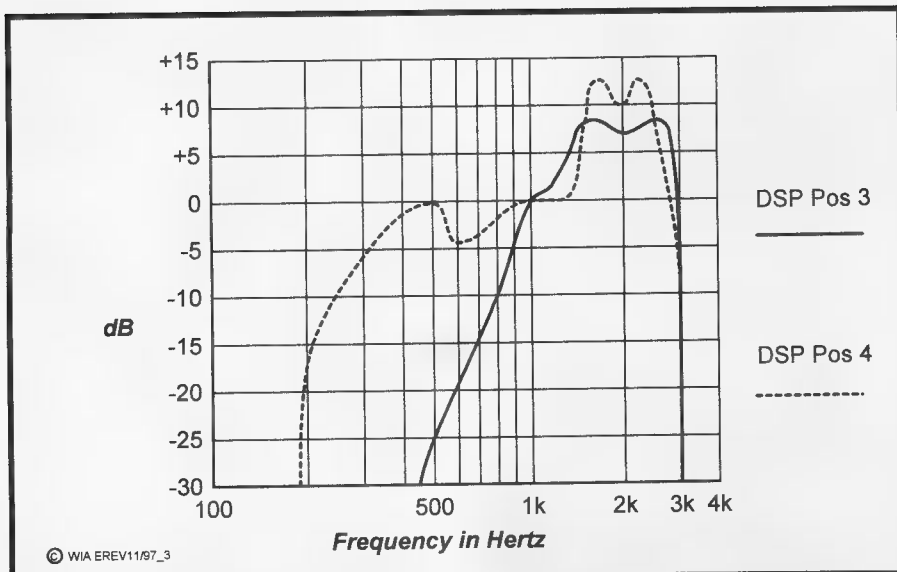
FT-920 and Six Metres

As mentioned earlier, I turned the FT-920 over to John VK3ATQ to see how performance lined up on the six metre band. John's standard of comparison is another Yaesu, the FT-650, which he describes as a better-than-average performer.

His first complaint was the lack of general coverage between 30 and 48 MHz. Serious six metre operators like to chase the MUF past 10 metres. Noise figure measurements taken at 50.1 MHz gave 4.0 dB with the pre-amp in and 13 dB with the pre-amp out. These relate to an MDS with the 2.4 kHz band width of -136 dBm and -127 dBm respectively. The noise figure of the FT-650 at the same frequency and under the same conditions measured 2.5 dB.

John found that the transmitted audio, although of excellent quality, lacked the necessary punch to get through at tropospheric propagation limits. The FT-650 was easily readable over a 300 km path where the FT-920 was not.

As noted earlier, the final current on 50 MHz was higher than expected. John suspects that this might be due to the transmitter having an output impedance of something other than 50 ohms. Putting in the ATU to compensate for this could then upset the match to the receiver and give the slightly inferior noise figure. You might find that the receiver performs



The FT-920 transmit audio response on 14.2 MHz with DSP switched to position 3 and position 4.

better with the ATU switched out on receive.

John reported that the DSP noise reduction effect was hard to evaluate. It appeared to make very little improvement, but suggested he would like more time to evaluate this. Thanks, John, for your interesting input to this review. I am hoping that John will be able to add his comments to future reviews.

FT-920 Instruction Manual

Actually called the "Operating Manual", it covers 94 pages and is generally well presented. Strangely, there are a few typographical errors. For instance, the page on phone patch operation is headed "Phone Pacht Operation". Well, I guess we even have a few in *Amateur Radio* from time to time.

Operating instructions are very well covered and there is even a full schematic diagram included together with details on the installation of the optional filters and the high stability master oscillator. Several pages are devoted to computer operation of the transceiver, which can be organised with very little trouble. You might be tempted to try it. As usual there is no technical information. Perhaps one day!

One thing I would like to see is a more durable cover to the manual. I have a feeling that the one on it will soon get dog eared.

FT-920 Conclusions

I guess the first question to ask a reviewer is, would you buy one? While I have to admit that I am not in the market for a new transceiver, if I was the FT-920 would be near the top of my shopping list for the following reasons. Firstly, and most important to me, is that this rig has excellent transmitted audio quality on SSB. I admit that I have been a Kenwood enthusiast for years for this very reason. I would put the audio quality of the FT-920 right at the top of the pile along with possibly half a dozen other transceivers some of which are not necessarily new models either.

Next, the tuning ergonomics are among the best I have ever used and certainly very superior to the main transceiver I am using at home at the moment. The digital signal processing works well and, along with an excellent noise blanker, will produce readable signals under very poor conditions.

The FT-920 is really in a class by itself and the choice boils down to whether you require a second receiver or not. I don't believe that I would. The excellent two VFO system of the FT-920 would satisfy me.

Lastly, I like the look of the FT-920. I know you cannot judge a book by its cover, but I was impressed by its looks from the first time I saw it. However, there are three negative features where I

believe Yaesu missed out. The first is the omission of an internal AC power supply. Even if it was available as an option I would go along with it. The second is the non availability of a narrow SSB filter to back up the excellent DSP; also, the 500 Hz CW narrow filter might just be a bit too wide for the keen CW operator. The third is the lack of a manual notch filter. The auto notch is great but this doesn't help the CW operator.

I hear on the grape vine that there is a new Yaesu linear amplifier in the pipeline, the VL-1000. I have unearthed a few specs which you might be interested in. It covers all the HF bands and six metres. It is rated at 1 kW output (I assume PEP, and possibly CW, but maybe not FM). It has inputs for two transceivers and four switched antenna outputs, has a built-in automatic antenna tuner, and is in two units, the amplifier and a separate power supply each measuring 410 mm wide, 135 mm high and 410 mm deep. The front panel size matches the FT-920 and FT-1000MP. It will, of course, have automatic band switching when used with most current Yaesu HF transceivers.

I look forward to seeing one. Sorry, but I have no information on the price. However, with a bit of luck we should see it early to mid 1988.

Our thanks to Dick Smith Electronics for the loan of the review FT-920 transceiver. I was sorry to see it go. Dick Smith Electronics are Australian agents for Yaesu equipment. You should contact them for information on price and availability.

*24 Sugarloaf Road, Beaconsfield Upper VIC 3808

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**Remember to
leave a three
second break
between overs
when using a
repeater.**