

EQUIPMENT REVIEW

Kenwood TS-50S All Mode HF Mobile Transceiver

Ron Fisher VK3OM * looks at Kenwood's latest amateur HF transceiver, "a delight to review".

Over the last ten to fifteen years, the size of most amateur gear has shrunk in size to a very marked extent. This has been most evident with VHF/UHF equipment which is now about half the size, and delivers twice (or more) the power of the early 1980s models.

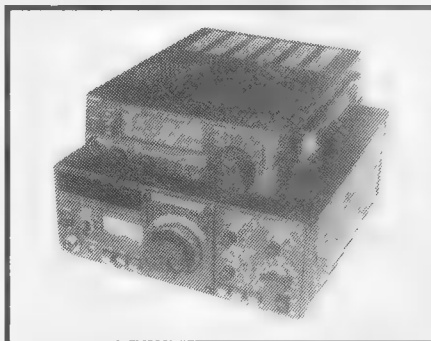
However HF mobile transceivers are still the same size and deliver the same power output as those of the early eighties. To be fair, the boxes now contain more features. In that time we have seen the addition of general coverage receivers, automatic antenna tuners, one hundred memories plus numerous bells and whistles. In some transceivers, the weight has been reduced by using plastic in place of steel for cabinet construction but still the size remains much the same.

Well now things have changed. The new Kenwood TS-50S is a fully featured HF 100 watt transceiver that is just under half the volume of the original TS-120S. Taking this one stage further, the TS-50S is actually smaller in size and about the same weight as the original Kenwood synthesized two metre transceiver, the TR-7400A. The TS-50S is a completely new development in amateur HF transceivers. It is not based on an earlier design.

This rig may well tempt many amateurs to have a try at HF mobile operation for the first time, and certainly entice many existing mobile operators to sell their old rigs and buy a TS-50S. Have a good look at the comparison photo of the TS-50S, and make up your own mind. I think you will be impressed.

The TS-50S Features and Facilities

At first sight, the small overall size is almost unbelievable. The overall



The physical size difference between the TS-50S and a TS120 is quite significant.

dimensions are 179mm wide, 60mm high and 233mm deep. It weighs in at only 2.9 kg. The front panel area of the TS-50S is well under half that of the TS-440S. The receiver section receives SSB, CW, AM and FM with 2.5 kHz selectivity for SSB, 5 kHz for AM and 12 kHz for FM. The same modes are also available on transmit. Receiver coverage is specified as 500 kHz to 30 MHz, but in fact the receiver covers down to 200 kHz with good sensitivity. The transmitter has three power output settings, 100 watts, 50 watts, and ten watts. As with many other facilities, these are selected via a menu set up system. More about this later. The transmitter operates on all amateur bands from 160 to 10 metres. The appropriate side band is selected automatically, but the other sideband can be selected by the push of a button. No antenna tuner is built in to the transceiver, but a miniature automatic ATU is available as an option. This matches the TS-50S in size and shape.

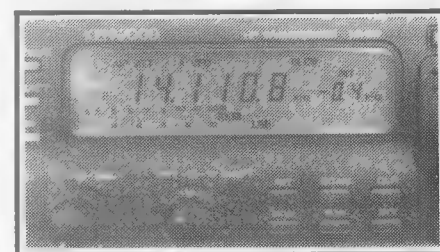
Band selection is via two small up/down buttons above the tuning control which select each amateur band in turn. The "MHz" button changes this to general coverage selection in either one MHz or 500 kHz steps. Each band selected

remembers the previous frequency, mode, selectivity and front-end setup such as receiver preamp and attenuator. The tuning control is naturally fairly small, it measures 35 mm in diameter but is very smooth in its action. A small switch under the knob gives two degrees of tension. The first gives a smooth spinning action and the second a firm feel which would be ideal for mobile operation.

Normal tuning rate is in 5 Hz steps which gives 0.5 kHz per knob revolution. As the knob is rotated at a faster rate, the step sizes increases and so it is possible to tune up the band at a rapid rate. Frequency readout is via a large LCD multi-function display which incorporates an "S" / Power output meter and a wide selection of status indicators. As normally set up, frequency readout is to 100 Hz, but it is possible to select a 5 Hz readout via an optional selection from the menu set-up. Once this is selected you can actually get down to a one Hz readout by using the "fuzzy logic" facility. Again more about this later.

Many of the transceiver parameters can be controlled via the microphone. Four small buttons have been added to the front of the microphone which otherwise looks similar to the normal Kenwood MC-42. Each of the four buttons can be assigned any of the forty or so functions in the menu set-up. The usual up/down buttons on the top of the microphone provide for stepping in the VFO mode or memory selection when in memory mode. The VFO steps via the up/down buttons are selectable for 10 or 100 Hz, or 1, 5 and 10 kHz. In addition to this, steps on the standard broadcast band can be switched to either nine or ten kHz spacing for AM reception.

The TS-50S sports 100 memory channels. These can be programmed



The main panel and frequency readout of the TS-50S.

with frequency, mode, filter band width, AGC setting and the receiver front-end settings.

Naturally, there are two VFOs and these can be utilised for split operation. When in this mode, the transmit frequency can be monitored via the "TF-SET" which is a feature of most current Kenwood HF transceivers.

The CW operator hasn't been forgotten either. A 500 Hz CW filter is available as an option and the return to receive time is adjustable from 100 ms to 1.8 seconds. Another useful CW function is the "reverse" receive selection which allows reception on the other sideband to help reduce interference.

The TS-50S is also very suitable for data transmission.

No speech processor is included but a carrier insertion adjustment allows optimum setting of the frequency response. This is adjustable from the standard setting by - 100 to + 200 Hz. The front panel of the TS-50S is very simple. There are only five rotary controls, tuning, RIT, IF shift AF gain and squelch. Push buttons control power on/off, AT tune which switches the external automatic ATU, AIP/ATT switches the AIP and front-end attenuator. AIP or Advanced Intercept Point switches out the receiver RF amplifier to give an improved intercept point at the expense of a little front-end gain and the "ATT" switches in a 20 dB front end attenuator. The AIP and the ATT can be selected individually or in tandem.

Noise blanker is simply on or off. No adjustment is provided. The six buttons to the left of the tuning control are for RIT and memory functions. The RIT can be selected to cover either +/- 1.1 kHz or +/- 2.2 kHz. There is no transmit offset.

Above the tuning control are four buttons which control the up/down band selection, the MHz button that switches between general coverage and amateur band selection and finally the frequency lock button. In addition to the frequency lock function this button also allows access to the set-up menu system.

To the right of the tuning control are the three VFO control buttons and in

the bottom right hand corner are the mode selection buttons.

Rear panel connectors are very straightforward. An SO-239 coax connector, and a standard six pin DC connector, ALC output, relay output for the control of a linear amplifier and jacks for a key and external speaker. Another six pin plastic connector provides control for the external automatic antenna tuner.

A 6 cm speaker is mounted in the top of the cabinet.

For such a simple layout a lot of features are included, so let's see how it all works out in practice.

The TS-50S on the Air

All the tests were carried out using a 13.8 volt DC power supply capable of delivering 20 amps. In hooking the TS-50S up, I note that Kenwood are now using new type fuse holders in the DC lead which incorporate automotive spade fuses. There is a fuse in each lead. The power switch on the front panel works through some sort of electronic device which requires the button to be held down for about a second. Then on it comes with "HELLO" showing on the display. After another second or so the rig comes to life.



We are ready to start work. The "Hello" message at switch-on.

The slow tuning rate of 0.5 kHz per knob revolution takes a while to get used to, but rotating the knob at about one rev per second speeds up the tuning rate to about 10 kHz per revolution. SSB signals sounded very clean although at high audio output, the speaker developed a rattle. I would think for mobile operation an external speaker would be an advantage. I connected my home station speaker and noted a big improvement in quality, especially on AM reception.

While tuning around on one VFO, I set the other to WWV on 15 MHz.

From a cold start, the transceiver was 24 Hz low, and after a couple of hours operation, it finished up 9 Hz high. A total drift of 33 Hz. If this is not good enough for you (you must be fussy!), an optional high stability master oscillator is available.

After tuning around for a while, I thought it time to try out the menu set-up. This is accessed by holding down the "F Lock" button for two seconds. The two programs are selected via the VFO A/B/ button. Now there are over forty selections available so there isn't space to describe them all. Kenwood list sixteen in their feature sheet, so I will borrow those. Here we go:

1. Tx power selection 100, 50, and 10 watts.
2. Five selections of LCD display brightness.
3. AGC slow/fast set up.
4. IF filter selection.
5. CW full/semi break-in selection
6. CW pitch 400 to 1000 Hz selectable in 40 Hz steps.
7. CW reverse mode.
8. Encoder lock on/off.
9. Beep tone on/off.
10. Morse mode sound on/off.
11. Repeater CTCSS tone setting including 1750 Hz.
12. Repeater CTCSS; Burst continuous setting.
13. Meter peak hold (Tx, Rx) on/off.
14. AM BC band step 9, 10 kHz selectable.
15. LSB/USB carrier point selectable -100 to +200 Hz on Tx.
16. Automatic power off function (3 hrs fixed intervals) on/off.

Once in the menu mode, the features are selected by the tuning control and the options via the up/down buttons.

The tuning knob has a very smooth feel. There is a degree of flywheel action in the free position and a firm tension in the second. The tension control is located under the tuning control. The memory system on the TS-50S is very versatile. The 100 channels store frequency, mode, receiver front-end setting, AGC, filter setting and tone frequencies. It is possible to transfer memories from one channel to another, to scroll through the contents of the memory channels without changing the received frequency. Band scan

upper/lower frequencies can be stored in memory 99. But perhaps the best feature of all is that via the menu set-up it is possible to make the memories tunable. In effect this gives you 102 VFOs.

Scanning of the memories can be set for the whole 100 channels or in groups of ten. Scan speed is adjustable via the RIT control. For the CW operator a 500 Hz filter is available as an option. It was not fitted to our review transceiver. CW keying appeared to be very good and no clicks were noted in our test. The receiver incorporates an IF shift which enables the band pass to be shifted in relation to the filter. Its effect was similar to other Kenwood IF shift systems. I found it very useful to reduce interference mainly on the high side of the response, and also reduce the effect of noise.

As seems to be usual these days with simplified transceivers, there is no RF gain control. I get the feeling these days, with good AGC systems, that most operators leave their RF gain flat out anyway. Perhaps I am one of the old school, I like to have one, and I do use it. However, I must say that I didn't really miss the RF gain on the TS-50S. The AGC is better than most and the judicious use of the AIP or attenuator overcame most of my problems. The squelch control works on all modes but would be of greatest use on FM. This was checked out on the 29 MHz band and found to be satisfactory.

The peak hold function on the "S" meter is useful. The last bar on the bar-graph holds for a second or so after the others have dropped away leaving the peak signal reading clearly visible. I know that many amateurs don't like bar-graph meters. Well this one works well, and it is hard to see how an analogue

meter could have been fitted to this transceiver anyway.

After a while, the urge to actually put it on the air became too great to resist, so some tests were arranged with Bill VK3ARZ. There is no microphone gain control for SSB as such. In the menu set-up two gain settings are selectable. All tests were carried out with the "High" setting. We optimised the audio response again via the menu set-up and found that +50 Hz from normal sounded best. This is adjustable in 10 Hz steps so you can set the quality "spot on" to suit your voice characteristics.

It sure is easier than opening up the transceiver and adjusting the carrier oscillator trimmers. After all this the audio was rated as excellent with plenty of punch. No speech processor is included in the TS-50S, but nevertheless the audio sounded very full. After several minutes of transmission, the heat sink at the rear of the cabinet became warm only. The internal cooling fan started up and ran for a few minutes keeping the heat sink at a constant temperature. The fan is audible but not too intrusive. Certainly, when mobile you would not hear it at all.

During these tests, Bill checked for intermodulation distortion and the results of this are included in the test section of this review. Unfortunately neither of the automatic antenna tuners were included with the review transceiver. They both look most interesting and I hope I might get an opportunity to look them over in the future.

Finally, I had a look at the "fuzzy logic" used in the tuning system of the TS-50S. This enables you to tune between the normal 5 Hz tuning steps, in effect to give you 1 Hz tuning. By giving the tuning control a quick flick any number between zero and five can be produced. The tuning will still progress in five Hz steps, but instead of starting at zero or five, might start at three. Most interesting to play with but possibly not a great deal of practical use.

The TS-50S on Test

First off, I checked the power output on transmit and the current drain. The three power settings were checked at 14.2 MHz and then the

high power output was checked on all bands.

Setting	Power out	Current Drain at 13.8 v
10 watt	9 watts	5.8 amps
50 watt	48 watts	12 amps
100 watt	95 watts	18 amps

Power output CW mode on each band

Band	Power out
160	105 watts
80	100 watts
40	96 watts
30	95 watts
20	95 watts
17	95 watts
15	95 watts
13	92 watts
10	90 watts

PEP output on SSB was about 5% higher than the CW figures.

It is interesting to note that the TS-50S specification makes no mention of the intermodulation distortion. While I don't have access to a spectrum analyser, a few tests were carried out to make an estimate of the distortion using a TS-940S as a standard. The TS-940S is rated at -37 dB for a third order distortion against a single tone output, which equated to -34 dB for a two tone signal. Our tests were carried out using normal speech modulation. We came up with a figure approximately 10 dB worse than the TS940S, which is significant.

Receiver Tests

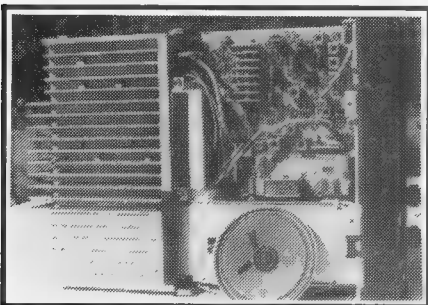
The first test was to check the "S" meter calibration.

S1	1.0 μ V
S3	1.3 μ V
S5	2.4 μ V
S7	5.2 μ V
S9	24.0 μ V
S9 + 20 dB	240.0 μ V
S9 + 40 dB	2.6 mV
S9 + 60 dB	.02 V

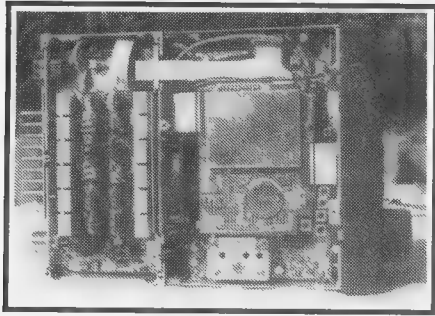
These tests were carried at 14.2 MHz. The AGC was checked at the same frequency.

Increasing the signal generator output, I found that there was no increase in audio output once the level reached 1 μ V. This is an excellent figure.

An 8 ohm load was connected to the external speaker output, and output and distortion were measured



View with top cover removed.



View with bottom cover removed.

using a 1 kHz beat note. Maximum output was 2.5 watts. The specified output of 2 watts with 5% distortion was met exactly. With the audio output reduced to 0.5 watts, the distortion measured 1%. With the audio gain control at zero, the residual noise output was -80 dBm. You won't have trouble with hiss or hum when using headphones on the TS-50S.

The audio frequency response on SSB was then checked. At the low frequency end the -6 dB point was 150 Hz, and at the top end 2700 Hz was -10 dB. It appears that Kenwood are using a degree of high frequency tailoring in the audio amplifier, as the "S" meter holds up to within -2 dB at 2700 Hz.

The overall sensitivity of the receiver was measured. This was within +/- 1 dB from 1.8 to 30 MHz. The figures here were taken at 14.2 MHz.

For 10 dB SINAD an input of 0.12 μ V was required. With the AIP switched in, this increased to 0.3 μ V and with the attenuator in the reading was 2.8 μ V. Of course it is possible to select both the attenuator and the AIP together but it's hard to see why this would be needed.

Finally, the selectivity was measured, again at 14.2 MHz and in the SSB mode.

The -6 dB was 2450 Hz and the -60 dB width was 3.9 kHz. Overall these results are very good. The only doubtful point is the intermod distortion which could be better. If the TS-50S is used mobile with a whip antenna, there would probably be no great problem, but if the transceiver was used at home with an efficient antenna, and possibly a linear amplifier, it could cause trouble. Kenwood might like to look into this.

The TS-50S Instruction Manual

The instruction manual runs to 60 pages which are crammed with information. Sections include installation both for mobile and fixed station operation. Controls and connectors are described very well over eight pages. Chapter three shows how to operate the transceiver in the four normal modes, plus data operation. Chapters four and five cover memory and scan functions. Chapter six is appropriately titled, "Other Useful Features". Indeed they are. Subjects covered include the operation of the dual VFOs, the IF shift and noise blanker. However chapter seven is without doubt the most interesting. It's here that the menu setting procedure is covered. This gives an insight into the wonderful facilities built into the TS-50S.

However, my usual grouch with instruction books, there is no technical description. A circuit diagram is included as is an almost complete specification. I score the instruction book an eight out of ten.

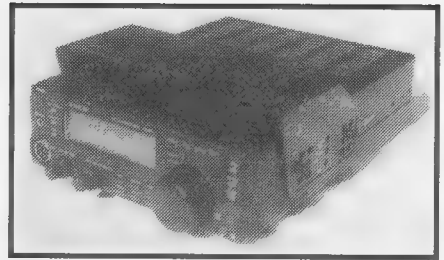
The TS-50S Conclusions

There is no doubt about it, the TS-50S is in a class on its own. It offers all the facilities needed for mobile operation and would make an excellent home station rig where space is limited. In some respects the performance is not quite up with the current larger transceivers, but it's not too far behind either. If you are using an older rig then the performance of this little transceiver will probably amaze you. Every time Kenwood bring out a new line of transceivers, they bring in updates that then carry on to the next models. With the TS-50S, the menu set-up system is one of the greatest advances for a long time.

However, I will conclude this review with a couple of "why don't they's".

Why don't they make the front panel removable? In many cases, even a transceiver as small as this might be hard to fit into a modern car.

Why don't they produce an AC power supply about the same size as the TS-50S? That would be wonderful for portable operation.



TS-50S with Mobile mounting Bracket.

I must admit that it has been a delight to review the TS-50S. I just might be tempted to acquire one before setting off for Northern Australia later this year.

The TS-50S is priced at \$1,549-00. The AT-50 automatic ATU is \$599, and the PS-32 power supply which can power both the TS-50S and the AT-50 is \$466-00.

My thanks to Kenwood Electronics Australia Pty Ltd for the loan of the review transceiver.

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BT

WIA News

A Hitch in Time

This month will be an extra second longer.

The International earth Rotation Service (IERS) has announced a "leap second" will be added on June 30th. The effect will be to retard Universal Coordinated Time (UTC) by one second.

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