



# Equipment Review

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## KENWOOD TS-440S TRANSCEIVER

The new Kenwood TS-440S is an upgraded replacement for the TS-430S. Believe it or not, the 430S has been around for just on four years and has been best a seller for Kenwood throughout that period. Even at the end of its run, the 430S was able to compete well with their opposition. I am sure that the 440S will give other amateur equipment manufacturers something to think about.

Firstly, let's look at the 440S and its design features — later we will see how and where it differs from the TS-430S.

The 440S is a compact, 12 volt operated HF transceiver, with a 100 kHz to 30 MHz general coverage receiver. It has all mode capability for SSB, CW, AM, FSK, and FM (all standard features), and incorporates a staggering 100 channel memory system with comprehensive scanning facilities. Selectivity can be selected independently of mode if required or selected automatically with mode selection.

Frequency selection can be made via the normal tuning control or from the front panel *dial up* key pad. An automatic ATU which covers the 80 to 10 metre amateur bands is internally installed as a standard feature. Options include two CW and two SSB filters whilst transceiver metering now included a PEP power output indicator as well as an automatic SWR and ALC position.

Transmitter final amplifier cooling has been improved for 100 percent duty cycle for up to one hour of continuous operation. This will be of great interest to RTTY operators!

The 440S is a triple conversion system with IF frequencies of 45.05 MHz, 8.83 MHz and 455 kHz, compared to the 430S's 48.055 and 8.83 MHz with 455 kHz being used only for the optional FM unit. AM (DSB) reception with the 430 required the optional YK-88A 6 kHz filter, the 440S uses a lower grade filter in the 455 kHz IF section. Oddly, the high grade AM filter is no longer available as an option.

Receiver functions include an IF shift, RIT, and XIT (transmitter offset tuning), noise blanker, AGC switchable for fast or slow decay time (but not AGC off), an audio notch filter, a 20 dB RF attenuator and a squelch control usable on all modes.

Transmitter functions include VOX, semi and full break-in for CW operation, an audio speech processor and an automatic ATU, as mentioned earlier.

General functions include a fluorescent tube frequency display to 100 Hz, but easily modified to give a 10 Hz display.

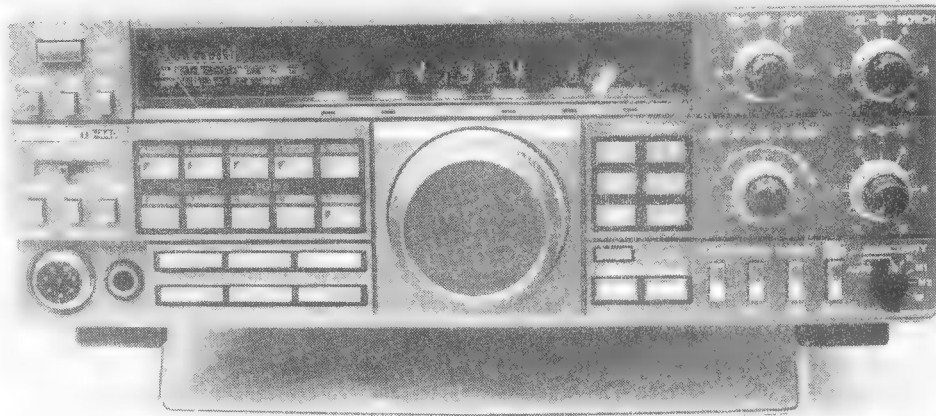
The 440S is capable of computer interface via an RS-232C port, however, whilst the interface unit is available as an optional extra, the required software is not.

The tuning rate is 10 kHz per tuning knob revolution in 10 Hz steps. The tuning rate increases with rapid turning of the knob, but the faster tuning rate is no longer switch-selectable as it was with the 430S.

The RIT/XIT now has a separate read-out for offset and, in addition, the main frequency readout changes by the amount of the offset.

The rear panel contains a multitude of connectors and facilities. There is the usual SO-239 antenna connector, a quarter-inch jack for a key, 3.5 mm jack for an external speaker and a six-pin DC power connector, all conventionally placed.

Three DIN connectors are provided for remote connections. A six-pin connector goes to the optional computer interface unit, while a seven-pin connector provides switching and ALC output for operation of a linear amplifier. A 13-pin connector



provides inputs and outputs for audio and data, as well as transceiver microphone muting — presumably used when RTTY is in operation.

The three VOX controls are on the rear panel as are input and output connectors for FSK. A spare connector is also thoughtfully provided.

You might say that this unit has something for everyone — but not quite. If you have an AT-250 automatic antenna tuner with your TS-430S and decide to retain this to use with your new 440S (after selling the 430 in Hamads), you may be disappointed. There does not appear to be any way to interface the two units. You could say, *why bother as the 440S includes the AT-440 ATU anyhow*. That's right, except that the AT-250 covers 160 metres whereas the in-built unit does not!

### TECHNICAL DESCRIPTION

The 440S is slightly larger than the 430S, but, even with the built-in ATU, weighs slightly less. It measures 27W x 9.6H x 31.3D cm (38 mm deeper than the 430S) and weighs six kilograms. The rear heat-sink has been increased in size and streamlined. The fan, which is thermostatically operated, is now fitted at the front of the final unit to achieve better air distribution.

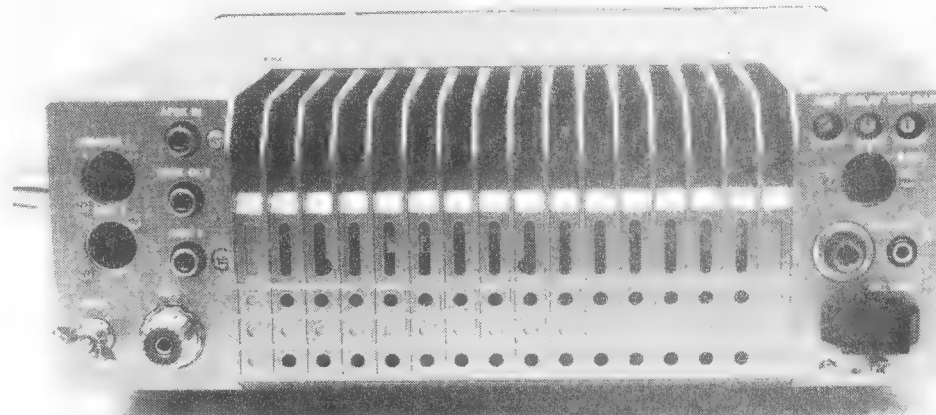
The front panel and main circuit boards are hinged to allow good access to all sections of the interior.

Reference to the block diagram shows, that after front end filtering, the signal goes straight to the first mixer, a pair of 2SK125s in push-pull. Like the 430S, it has no receiver RF stage. A similar pair of FETs are used in the second mixer, therefore, apart from the change of the first IF from 48 to 45 MHz, both units are much the same. But, from this point, things change.

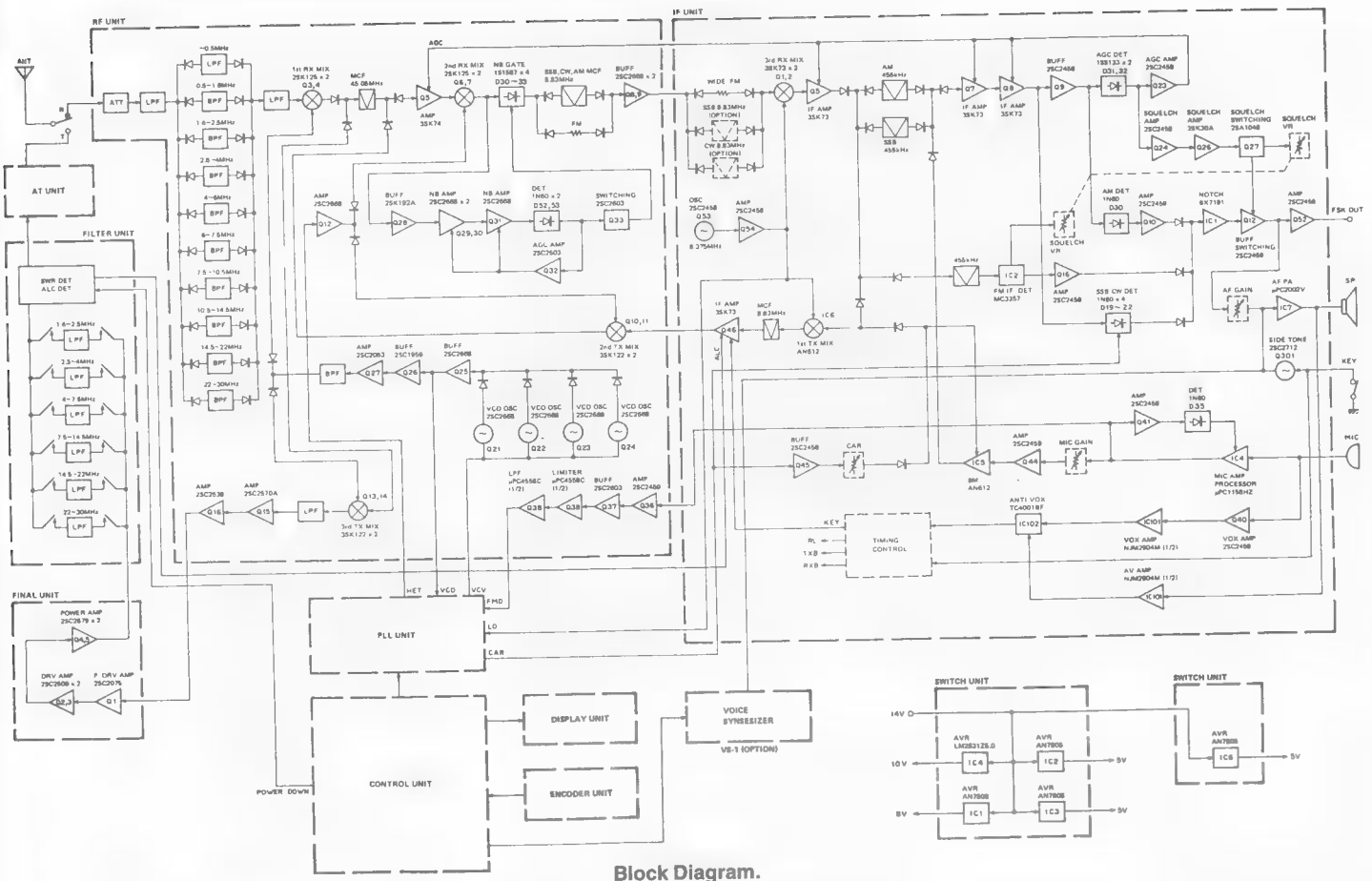
The second IF of 8.830 MHz is now reserved for the optional filters. There is a roofing filter provided with a bandwidth of about 12 kHz, but the main built-in selectivity is now at 455 kHz. With the optional 8.830 MHz filters installed, one of which, the YK-88S is the standard SSB filter in the 430S, they are effectively in series with the 455 kHz filters. In the AM and FM modes, the selectivity is at 455 kHz. Although the AM selectivity is 6 kHz at -6 dB, the same as the optional YK-88A filter for the 430S, it is much wider as we shall see later.

All mixers in the transmitter are push-pull 3SK122s with the exception of the first which is a AN612 IC.

The transmit driver and pre-driver stages use the same line-up as the 430S, but the final has been changed to two 2SC2879s. I have no data on these but assume they are up-rated over the 2SC2290s used in the 430S.



Rear view of the unit showing a multitude of connectors.



Block Diagram.

**ON-AIR**

In general, the TS-440S is a delight to use, however it seems that whenever a new model comes out, some of the best features of the older model get lost on the way. Let us look at them in turn.

The first thing that I noticed was the lack of a finger-hole in the tuning knob — when checking the entire tuning range for spurious signals, I concluded with a rather sore digit. Perhaps, to make up for this, the adjustable tuning knob tension is good, just rotate the ring at the rear of the knob until you have the tension you require. Personally, I would prefer a little less tension so that the knob would have more spin.

The filter switching from the front panel is a great idea, but unfortunately, as the review transceiver did not have any of the optional filters installed, selection was limited to 2.2 kHz for SSB or the wide AM position which is also selectable for Hi Fi SSB. (I would like to try the effect of the YK-88S SSB filter in circuit).

The 440S has only one tuning speed whereas the 430S had two selectable steps. It is possible to get a faster tuning speed on the 440S by rotating the knob at high speed, but, of course, this is not a tuning rate. (The faster rate on the 430S was most handy for AM reception).

Perhaps the most intriguing feature of the 440S is the 100 memory capability — I got up to 20 and then ran out of ideas, however, the ease of selection makes the use of the memory system almost preferable to the normal tuning. If you require a channel that is not in the memory, simply punch it in on the key pad.

Labelling of the key pad is rather dull (black on gray) so good lighting is necessary in the shack.

The receiver sounded very good with typical Kenwood quality. The internal 7.5 cm speaker is good, but audio quality from the transceiver justifies a good external speaker.

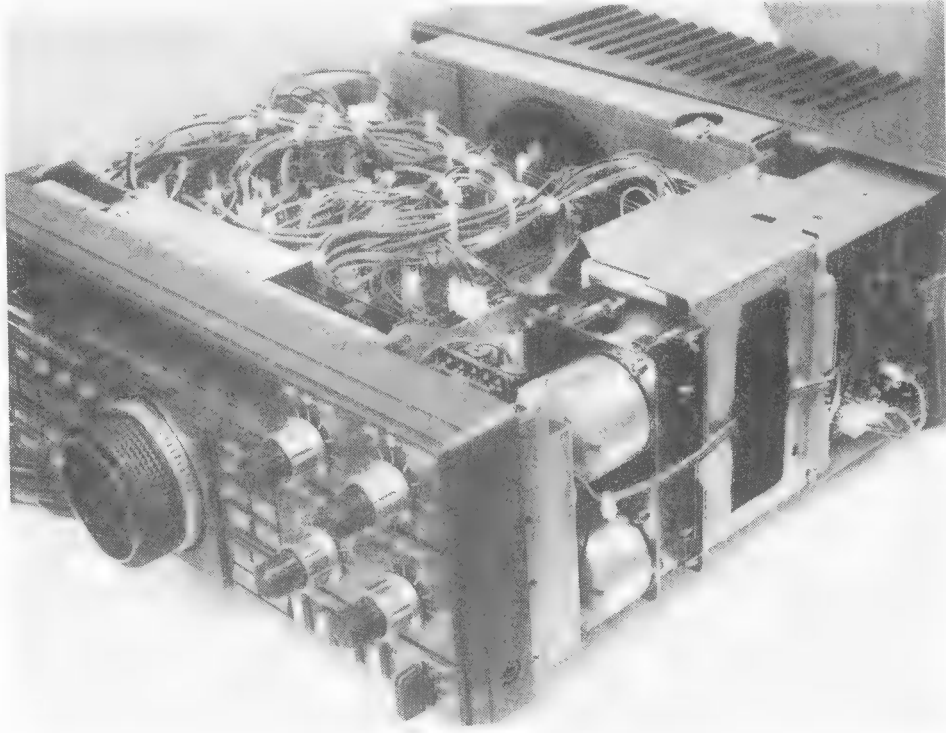
The RIT now has its own digital readout. In addition, the main frequency readout also changes with the RIT. XIT (transmit offset) is also

provided. Unlike the TS-930/940, which have an offset capability of 9.9 kHz, the 440S only has a 1 kHz offset.

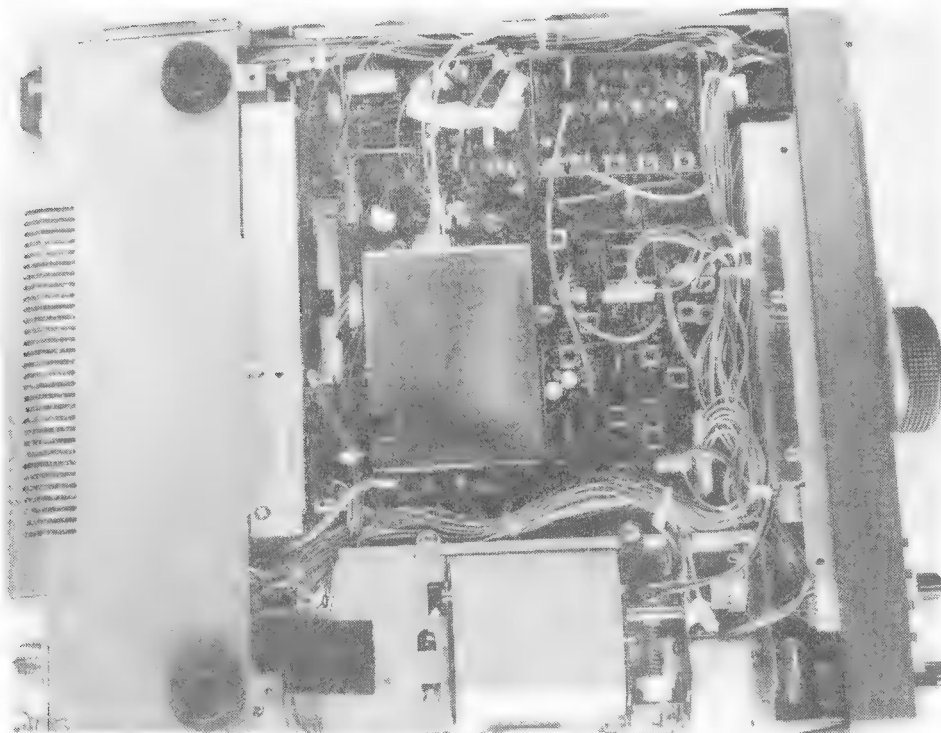
On the transmitter side, the highlight is undoubtedly the built-in automatic antenna tuner. I

would firstly refer readers to my review of the Kenwood AT-250.

Antenna tuners of the AT-250 or AT-440 type are designed to present a 50 ohm load to the transmitter from a coaxial line with a maximum



View showing the ATU in the bottom right-hand corner.



Bottom view showing the internal wiring.

SWR of about 3:1. Don't imagine that you will be able to feed a random length wire or a balanced feed antenna. However, so long as you appreciate the limitations, it will prove quite useful in many ways.

In use, the tuner was easy to use, but I found that the tune-up time was much longer than the tuner in the 930 or 940 transceivers.

New facilities have been provided for the keen CW operator. Full break-in or semi-break-in is selectable with a slide switch on the top left of the cabinet. As I must admit to not being a CW expert, all I can say is that the keying seemed to work very well.

Unfortunately, I was unable to give the FM mode an on air check due to the short time I had the transceiver. I would expect that the performance would be at least as good as the 430S, which is very good. The front panel carrier level control now operates in the FM mode so you do not have to run full power all the time as with the TS-430S.

A lithium battery is built into the 440s to retain memory and VFO frequencies when the DC supply is removed. As there seems to be some controversy about lithium batteries, it is worth noting that Kenwood recommend that the unit should be returned to a Kenwood dealer to have the battery replaced when this becomes necessary. In other words, it is not desirable that you should attempt to do this yourself. It appears that the transceiver will still operate without the lithium battery, but it will naturally *not* retain memories after it is switched off.

I think we will have to wait for a few years yet to find out the full effect, or otherwise, of these batteries.

Finally, in common with all current Kenwood gear, a voice synthesised frequency readout is available as an option. This along with the CW mode identification will be boon to sightless operators.

#### UNDER TEST

The following equipment was used to produce the figures during these tests.

A Drake W4 watt meter, Yaesu YP-150 terminating watt meter, Kenwood SM-220 monitor-scope, Daven audio power output meter, AWA F242A noise and distortion meter, Marconi TF-995A/5 signal generator, a 100 kHz crystal calibrator, and all tests were made with a regulated 13.8 volts applied to the 440S.

**Frequency Stability** — Stability was checked by running the receiver against VNG for long periods of time. No audible drift was detected. I also ran

the receiver in the SSB mode against the ABC Melbourne broadcast stations which have a long term stability of better than 1 Hz. Again, no audible drift was detected. (Kenwood claim a stability of  $\pm 10 \times 10^{-6}$ ).

**Transmit Power Output** — Power output was measured with full drive under CW conditions and then also checked for PEP output using the monitor-scope. PEP output was checked using both voice and two-tone modulation.

Band	CW O'put	PEP O'put
1.8	117	120
3.5	115	117
7	110	112
10	112	115
14	112	115
18	112	115
21	111	113
24	110	112
28	109	110

It was noted while doing these tests that the power output meter in the 440S was in very close agreement with the above figures.

The scope pattern was very clean at all times and the PEP figures were taken under two-tone conditions with no detectable distortion. On air tests with another station indicated that inter-modulation distortion was acceptably low.

**Receiver Tests** — The receiver audio was first checked. The extension speaker output was terminated with the audio power meter and connected to the noise and distortion meter. With an 8 ohm load, the residual noise with the audio gain fully off was -64 dBm, an excellent figure. Maximum audio power output was 2.5 watts at 32 percent distortion. At 1.8 watts, 10 percent distortion occurred which is just a bit better than the rated 1.5 watts. At .25 watts (an average listening level) distortion had dropped to 1.6 percent, a quite acceptable figure. The SSB audio response was checked by tuning across a signal from the crystal calibrator. The -6 dB points were at 100 Hz and 2.9 kHz. The curve was quite smooth between these points. The response for AM receive was checked with the following results.

100 Hz	-10dB	3 kHz	-4 dB
200 Hz	-4 dB	3.5 kHz	-6 dB
400 Hz	-1 dB	4 kHz	-7 dB
1 kHz	0 dB	5 kHz	-12 dB
2 kHz	-1 dB		

This means that you will get quite good quality for broadcast reception, but if you want to uncover

weak signals on the short wave broadcast bands, it is not so good. It is a pity that the YK-88A is not offered as an option that could be selected with the front panel selectivity control.

**S-Meter Calibration** — The S-meter was checked at 14.200 MHz.

S Reading	I'put Signal	Signal Increase
S1	1 uV	
S2	1.6 uV	4 dB
S3	2.5 uV	4 dB
S4	4.0 uV	4 dB
S5	6.3 uV	4 dB
S6	8.0 uV	4 dB
S7	10.6 uV	4 dB
S8	12.5 uV	4 dB
S9	40.0 uV	8 dB
S9 +10	100.0 uV	20 dB
S9 +20	500.0 uV	10 dB

S9 +30 1600.0 uV  
The S-meter is calibrated to S9 +60 dB, which represents a signal of 100 mV. I hope you don't strike too many of those on the amateur bands.

The receiver was checked on each amateur band for sensitivity at an input signal of .25 uV. Also, the signal required to give an S9 meter reading.

Freq	S/N Ratio at .25 uV input	Input for S9
1.8 MHz	7 dB	40 uV
3.5 MHz	14 dB	40 uV
7 MHz	15 dB	40 uV
10 MHz	11 dB	40 uV
14 MHz	14 dB	40 uV
18 MHz	13 dB	40 uV
21 MHz	10 dB	50 uV
24 MHz	7 dB	80 uV
28 MHz	10 dB	50 uV

The receiver input was terminated with a 50 ohm load and the entire tuning range was checked for spurious signals. This is a time consuming job. A total of 27 signals were heard. Mostly they were in the region of .1 to .15 uV equivalent signals with the strongest on 18,561 MHz, which reached about .5 uV. For a triple conversion receiver with coverage from 100 kHz to 30 MHz, this is very good.

Squelch sensitivity was checked in the FM mode at 29.6 MHz. A signal level of .3 uV opened the squelch with it set very finely.

The front end attenuator rated at 20 dB was checked at exactly that figure! The attenuator is very handy for checking the calibration of the S-meter and for giving reports on antenna performance such as front to back ratio readings.

FM performance was checked at 29.600 MHz. With a signal level of .7 uV and 3 kHz deviation, a signal:noise ratio of 15 dB was measured. Squelch sensitivity at the same frequency and in the FM mode was .31 uV.

**AGC Performance** — AGC threshold was about .6 uV. Signal level was increased from .5 uV to the maximum output of the generator. The increase in audio level was measured at 1.5 dB.

**Notch Filter** — The notch filter operates in the receiver audio section as distinct from the IF notch filter in the TS-930/940. There are some disadvantages in audio notch filters in that they do not reduce the level of the interfering signal but only the effect of it after detection. Never-the-less the 440S filter does an excellent job. Attenuation was measured at three frequencies with the following results.

500 Hz	-35 dB
1.5 kHz	-35 dB
2.5 kHz	-40 dB

The actual notch is very sharp and so has very little effect on the received audio quality. This does mean that it can be a bit critical to adjust but once you get an idea of where to set the knob for a given heterodyne frequency it becomes easier.

## THE INSTRUCTION MANUAL

I must say that Kenwood have improved their instruction manuals. They still have a way to go but the improvement is worthwhile. There is even a page devoted to circuit description.

Sections include: *Installation; giving basic details on setting up the transceiver for fixed and mobile operation.*

The operation section firstly describes the function of each control and then goes into detail on frequency selection, memory and scanning setup.

Details are provided on the installation of the optional filters and on the several internal pre-set controls.

Fault finding is limited to operation faults or the check the antenna is connected type.

Kenwood do produce excellent service manuals for their equipment and, while I have not seen the 440S version, I would suggest it could be compulsory reading for the enthusiastic owner.

In general, the instructions are well written but one gem states the *knobs, front panel and cabinet are likely to become solid after extended use.* So watch out, you have been warned.

## CONCLUSIONS

The 440S is a delightful transceiver to operate. I am sure it will be another winner for Kenwood. Now that all modes are included as standard, I would put the 440S near the top of a short list.

Thanks to John Hill, of Emtronics Melbourne, for the loan of our review model.

## EVALUATION AND ON-AIR TEST AT A GLANCE

### APPEARANCE

- Packaging
  - \*\*\* Double carton with foam inserts.
- Size
  - \*\*\* Not the smallest, but very acceptable.
- Weight
  - \*\*\* Again not the lightest, but certainly very good considering the ATU is in-built.
- External Finish
  - \*\*\* Excellent presentation.
- Construction Quality
  - \*\*\* Very good construction and accessibility.

### FRONT PANEL

- Location of Controls
  - \*\*\* Controls cover 57 functions. Layout is remarkable.
- Size of Knobs
  - \*\* A bit on the small size, but good considering the above remarks.
- Labelling
  - \*\*\* Very clear except for the key pad numbering.
- Status Indicators
  - \*\*\* Six function indicators, plus Morse and light mode indicators.

### VFO ACTION

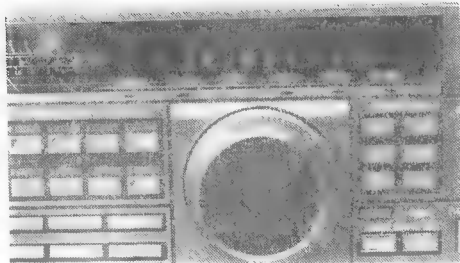
- Tuning Knob
  - \*\*\* Good size and adjustable tension, but no finger-hole.
- Tuning Rate
  - \*\* Only one tuning rate selectable. Stepping speed increases with fast rotation of knob.
- Digital Readout
  - \*\*\*\* 100 Hz readout with 10 Hz selectable. Bright and clear readout.

### VFO STABILITY

- \*\*\*\* Drift too low to detect.

### RECEIVER OPERATION

- Memories
  - \*\*\*\* Breaks all records.
- IF Shift
  - \*\* Useful to adjust audio quality and reduce some interference.
- Notch Filter
  - \*\*\* For an audio notch, it works remarkably well.
- Spurious response
  - \*\*\* Quite a few but all very low (see test section).
- S-Meter
  - \*\*\* Constant 4 dB per S-point up to S9 (see test section).
- AGC Performance
  - \*\*\* Smooth action. Fast/Slow selectable, but not off.



Close-up of LED Display.

### SIGNAL HANDLING

- \*\*\* No cross mod heard except when noise blander selected.

### RIT/XIT

- \*\*\* Only  $\pm 1$  kHz, but separate readout and main readout follows.

### SENSITIVITY

- \*\*\* Very adequate (see test section).

### PRE-AMP/ATTENUATOR

- \*\* No pre-amp, 20 dB attenuator only.

### RF GAIN CONTROL

- \*\*\* Smooth progressive action.

### NOISE BLANKER

- Woodpecker
  - \* No use at all.
- Ignition and General Noise
  - \*\* Good on ignition noise, only fair on power line noise.

### RECEIVED AUDIO QUALITY

- Internal Speaker
  - \*\* Not bad for a built-in speaker.
- External Speaker
  - Matching speaker not available for test, very good on my usual station speaker.
- SSB/CW Received Quality
  - \*\*\* Low distortion and very clean.
- AM Received Quality
  - \*\*\* Good quality for local broadcast stations. Selectivity too broad for AM DX reception.
- Headphone Output
  - \*\*\* Stereo headphones compatible. Relative level very good.

### TRANSMIT OPERATION

- CW and PEP Output
  - \*\*\*\* Very consistent on all bands (see test section).
- Audio Quality
  - \*\*\* With supplied hand microphone, very acceptable.
- Audio Processor
  - \*\* Quite effective if not pushed too hard.
- Metering
  - \*\*\* ALC, calibrated power output and auto-SWR.
- Relay Noise
  - \*\*\* Very quiet.
- CW Operation
  - \*\*\* Selection of full or semi break-in.
- Cooling
  - \*\*\* Runs very cool with the new improved heat sink. Fan very quiet when running.

### MANUAL

- Owners Hand Book
  - \*\* Somewhat improved over earlier Kenwood manuals, but still more information and better illustrations needed.

### OVERALL RATING

- \*\*\*\* Although there are a few points of criticism, the overall concept is excellent.
- Rating Code: \* Poor; \*\* Satisfactory; \*\*\* Very Good; \*\*\*\* Excellent.

## DOC QSP

### IT IS ILLEGAL! !

All readers should note that, under the Regulations for the Radcom Act, it is illegal for amateur stations to indulge in conversation with unidentified stations or cause disruptive communications. Amateurs who indulge in such practices are putting their own licence in jeopardy.

## NEWS FROM LONDON

### CLASS B MORSE NOW PERMANENT

Last year's experiment, allowing British Class B (VHF and UHF) licensees to use Morse on the air, finished on 31st March. During the year, the RSGB, on behalf of the DTI, issued over 6000 letters of temporary variation of the licence, to those wishing to participate in the experiment.

On 2nd May, the DTI announced that following the successful completion of the experiment, the concession is now a permanent feature of the B licence, and that the experimental restriction of Morse operation to the station address no longer applies.

Class B licensees can only obtain A licenses (all bands) by passing the 12 WPM Morse test, and this feature allows learners to practice, in the bands for which they are licensed, under real operating conditions, in preparation for the test. There are no specific restrictions for learners, but the DTI recommends that class B Morse operation should be in accordance with RSGB guidelines issued during the experimental period.

These include station identification by telephony before and after a Morse transmission; no operation in parts of a band reserved exclusively for Morse — to avoid interference with regular CW operation; using on/off keying of an audio tone in the channelised (FM) parts of a band; using any authorised keying method in the multi-mode sections of the bands.

Figures released by the DTI on 2nd May show 28 450 class A, and 27 180 class B licensees currently in the United Kingdom.

Contributed from AR's London Correspondent, Tony Smith G4FAI

## COUNTRY UPDATE ON 10, 18 & 24 MHz BANDS

Following is an update of countries which authorise use of the new HF bands.

**10 MHz** — Algeria; Andorra; Antigua; Argentina; Australia; Austria; Bahamas; Belize; Bermuda; Botswana; Brunei; Canada; Cayman; China; Colombia; Costa Rica; Cyprus; Czechoslovakia; Denmark; Djibouti; Dominica; El Salvador; Faroe Islands; Fiji; France; Gabon; German Democratic Republic; Federal Republic of Germany; Gibraltar; Greece; Grenada; Honduras; Hong Kong; Indonesia; Ireland; Israel; Italy; Japan; Korea; Luxembourg; Malaysia; Malta; Monaco; Montserrat; Netherlands; Netherlands Antilles; New Zealand; Nicaragua; Nigeria; Norway; Panama; Papua New Guinea; Peru; Portugal; San Marino; Senegal; Solomon Is; South Africa; Spain; Sri Lanka; Sweden; Switzerland; Syria; Tonga; Trinidad; Turkey; United Kingdom; USA; Vanuatu; Western Samoa; Yugoslavia and Zambia.

**18 MHz** — Algeria; Andorra; Antigua; Argentina; Australia; Austria; Bahamas; Bahrain; Botswana; Brunei; Cayman Island; China; Colombia; Costa Rica; Cyprus; Denmark; Djibouti; El Salvador; Faroe Islands; France; Gabon; German Democratic Republic; Federal Republic of Germany; Grenada; Honduras; India; Ireland; Israel; Italy; Kuwait; Luxembourg; Malaysia; Monaco; Netherlands; Netherlands Antilles; New Zealand; Nigeria; Norway; Oman; Panama; Peru; Portugal; San Marino; Senegal; South Africa; Sri Lanka; Sweden; Switzerland; Syria; Tonga; Trinidad; Turkey; United Kingdom; Vanuatu; Yugoslavia and Zambia.

**24 MHz** — Algeria; Andorra; Antigua; Argentina; Australia; Austria; Bahrain; Botswana; Cayman; China; Colombia; Costa Rica; Cyprus; Denmark; Djibouti; El Salvador; Faroe Islands; France; Gabon; German Democratic Republic; Federal Republic of Germany; Grenada; Honduras; India; Ireland; Israel; Italy; Kuwait; Luxembourg; Malaysia; Monaco; Netherlands; Netherlands Antilles; Nigeria; Norway; Oman; Panama; Papua New Guinea; Peru; Portugal; San Marino; Senegal; South Africa; Sri Lanka; Sweden; Switzerland; Syria; Tonga; Trinidad; Turkey; United Kingdom; USA; Vanuatu; Yugoslavia and Zambia.

from The ARRL Letter, 9th May 1986