THE PETER HART REVIEW

# Kenwood TS-60S 50MHz Mobile Transceiver

KENWOOD LAUNCHED their TS-50S small HF mobile transceiver onto the market early in 1993. It was reviewed in this magazine in the May 1993 edition and today still remains as the smallest full power, fully featured HF transceiver available. A year later, Kenwood unveiled the TS-60S. This 50MHz transceiver is virtually identical in features and styling to the HF transceiver but covers just the 50MHz band with an output power of 90 watts.

50MHz really comes into its own for a year or two around sunspot maximum. Unfortunately we will have to wait another seven years or so for real ionospheric DX propagation to return, but during the Summer months, sporadic E propagation gives plenty of contacts up to 2000 miles or more with occasional US and African DX [see this month's *VHF/UHF News – Ed*]. It was indeed fortunate that I had this radio to review during a particularly lively period of sporadic E this Summer.

## PRINCIPAL FEATURES

INCLUDED HERE IS A summary of the principal features. More comprehensive coverage of the features is given in the TS-50S review [1].

The TS-60S covers the frequency range 50 to 54MHz as supplied in Europe. However, a simple dealer modification enables the receiver to cover the range 40 to 60MHz as supplied in other parts of the world and this is particularly useful for monitoring Eastern European TV channels as a guide to band openings. The radio is 12V operated and covers USB, CW, AM and FM modes. LSB can also be selected.

The 33mm diameter main tuning knob tunes in 5Hz step size at low speeds (2kHz per revolution) which increases smoothly up to 200Hz step size as the knob is turned faster, through the use of fuzzy logic control. The FM rate is ten times higher. UP/DOWN keys select either 500kHz or 1MHz increments or step through the sub-bands. The frequency range of the transceiver may be continuously tuned or selected in three sub-bands, where each sub-band stores the last used frequency and mode. 100 battery backed memories are provided with twin A/B VFOs for split frequency, scanning and TF-SET from the microphone.

An RIT clarifier is provided, functioning on receive only, operating over the range +/- 2.2kHz. IF filter bandwidths are selected automatically according to mode with 2.4kHz standard on SSB and CW and 6kHz on AM. An optional narrow 500Hz bandwidth filter


may be fitted on CW. An IF shift control is also provided to help with interfering adjacent channel signals.

The receiver front-end may be set for optimum sensitivity or improved signal handling with reduced sensitivity (AIP setting), and an additional 20dB input attenuator may also be selected for really big signal problems. The normal and AIP settings correspond to the receiver RF amplifier being switched in or out of circuit.

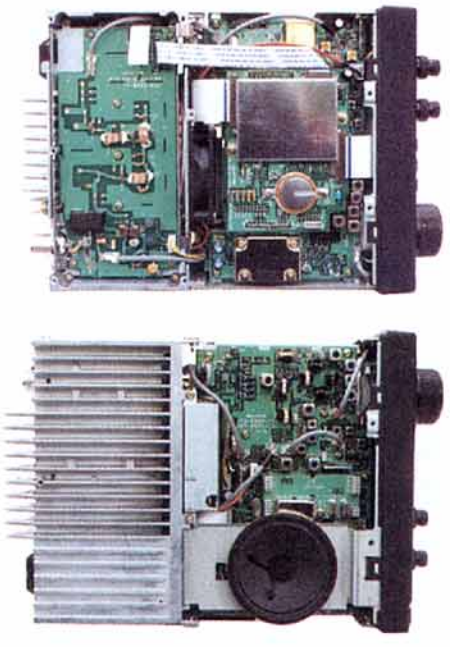
A noise blanker is provided and fast or slow AGC presettable for each mode. There is no RF gain control.

The transmit power is switchable to three output settings, nominally 90, 50 or 10 watts output. There is no speech processor or VOX on SSB. On CW either semi or full break-in may be selected.

Two set-up menus are provided to enable some 41 of the functions of the radio to be tailored to individual preferences. These include step sizes, scan parameters, transmit audio characteristics, CW pitch, delay and reverse sideband, beep and alarm messages, automatic power off and many other characteristics. The MC-47 microphone provided with the radio has four function keys which may be programmed to select from some 27 different functions.

The backlit liquid crystal display indicates the usual status messages, frequency to 100Hz resolution, memory number, RIT offset and bargraph S meter. The rear panel provides relay controlled linear switching, key and speaker interfaces only.

The TS-60S is provided with a mobile mounting bracket and 60-page instruction manual with circuits. This is similar to the TS-50S manual.



**TS-60S top view and TS-60S bottom view with covers removed.**

## DESCRIPTION

THE TS-60S REALLY IS a tiny radio for its capabilities, measuring only 179mm (W) by 60mm (H) by 233mm (D) and weighing only 2.9kg. The construction is rugged and compact using surface mount technology extensively. The PA is housed in a substantial finned diecast assembly and a fan is switched on when the heatsink becomes hot. A thin 6.5cm diameter speaker is mounted upward facing through the top of the case.

The receiver is double conversion on SSB, CW and AM with intermediate frequencies of 73.045 and 10.695MHz. On narrow band FM, there is a third conversion to 455kHz. The transmit signal is generated at 10.695MHz and mixed via 73.045MHz to the 50MHz final frequency.

## MEASUREMENTS

THE MEASUREMENTS WERE made with the TS-60S powered from a 13.6V power supply and are detailed in the table. Note that the NOR setting in the table corresponds to the front-end setting for maximum sensitivity.

The receiver sensitivity is entirely adequate, well within the quoted specification. The S-meter calibration is the same on SSB, CW and AM and gives good range and linearity but on FM the range is cramped as usual. The resolution is limited by the bargraph type display.

Rejection of the IFs and image was in excess of 95dB – a very good result and the receiver was very clean in terms of other unwanted spurious signals. The receiver third order intercept and dynamic range was much better in the AIP setting than with the RF amplifier in circuit. This shows that the performance of the receiver RF amplifier is limiting the signal handling capabilities of the receiver.

The transmit output power on all modes was considerably higher than specified on all three output settings. At full output on SSB, two-tone intermodulation products were poor at only –15dB but improved substantially at the 100 watt level and below. Harmonic output levels were good and the critical 2nd harmonic which falls in the FM broadcast band was at a low level of –75dBC. The frequency calibration was within the display resolution of 100Hz.

## ON-THE-AIR PERFORMANCE

IT WAS VERY FORTUNATE that good sporadic E conditions were around during the period I had the radio for review. This gave rise to plenty of contacts around Europe and further afield to JY, 5T and openings to W, VE and CY9. The radio performed very well on both receive and transmit and the extra transmit power was useful with my long lossy length of feeder.

Although the radio is small it is very easy and convenient to use. However, a finger indent for the small tuning knob would be a great help. The variable speed-up on the tuning I regard with mixed feelings. It is very convenient and effective for tuning over moderate distances, but if only small changes are needed, it tends to move the frequency unexpectedly far if the knob is turned fast.

## CONCLUSIONS

THE TS-60S IS AN EXCELLENT radio for the 50MHz band. Although ideally suited to mobile use, this band is not exactly popular for mobile operation and in most cases the radio will be used fixed. However, its small size and weight makes it ideal for lightweight expeditions and taking on holiday and is easily taken as hand luggage on aircraft. The performance is good and in the AIP setting an excellent dynamic range is achieved. A generous 100+ watts output power was achieved in the review radio as against the 90W specification, but this may not be typical of all radios.

The current price of the radio is just under £1000 and as such it is quite expensive for a monoband radio. As a next step, perhaps Kenwood will consider combining the TS-50S and TS-60S to give an HF plus 50MHz radio. This is now a popular combination and if it could be provided in such a small case would be a very interesting radio.

## KENWOOD TS-60S MEASURED PERFORMANCE

### RECEIVER MEASUREMENTS

| | NOR | AIP |
|---|---|---|
| SSB sensitivity for 10dB s+n:n | 0.13uV | 0.32uV |
| AM sensitivity for 10dB s+n:n, 30% mod | 0.9uV | 2uV |
| FM sensitivity for 12dB SINAD 3kHz pk dev | 0.18uV | 0.63uV |
| Third order intercept (50kHz spacing) | –6dBm | +20dBm |
| Two–tone dynamic range (50kHz spacing) | 86dB | 98dB |

| S–READING | INPUT LEVEL | | | |
|---|---|---|---|---|
| | SSB(NOR) | SSB(AIP) | FM(NOR | FM(AIP) |
| S1 | 0.9uV | 7uV | 0.5uV | 4uV |
| S3 | 1.4uV | 10uV | 0.7uV | 5uV |
| S5 | 2.5uV | 20uV | 0.9uV | 7uV |
| S7 | 7uV | 56uV | 1.3uV | 10uV |
| S9 | 25uV | 200uV | 2uV | 14uV |
| S9+20 | 280uV | 2mV | 2.8uV | 22uV |
| S9+40 | 3.2mV | 25mV | 4uV | 32uV |
| S9+60 | 22mV | 160mV | 5.6uV | 40uV |

| MODE | IF BANDWIDTH | |
|---|---|---|
| | –6dB | –60dB |
| SSB,CW | 2480Hz | 5120Hz |
| AM | 7550Hz | 25.2kHz |
| FM | 13.5kHz | 18.4kHz |

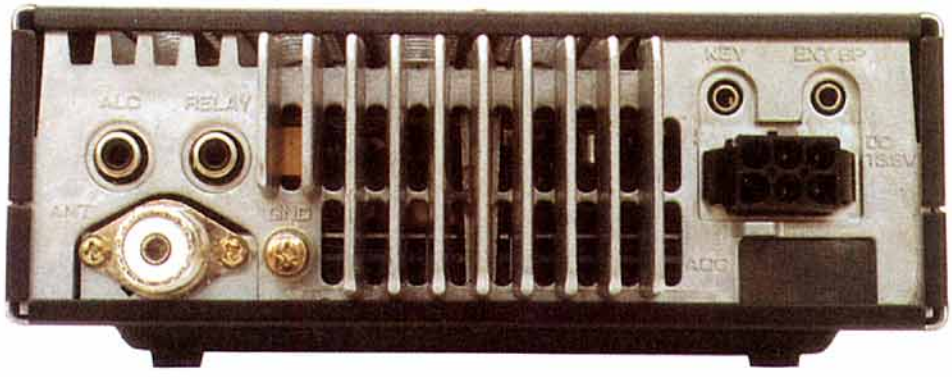
AGC threshold: 0.56uV
100dB above AGC threshold for +1.5dB audio output
AGC attack time: 5–10ms
AGC decay time: 0.1–0.2s (fast), 2–3s (slow)
Max audio before clipping: 1.9W into 8ohm at 1% distortion

| TONE SPACING | 3rd ORDER INTERCEPT | 2 TONE DYNAMIC RANGE |
|---|---|---|
| 3 kHz | –34dBm | 68dB |
| 5 kHz | –31dBm | 70dB |
| 10 kHz | –20dBm | 77dB |
| 15 kHz | –10dBm | 84dB |
| 20 kHz | –6dBm | 86dB |
| 30 kHz | –6dBm | 86dB |
| 40 kHz | –6dBm | 86dB |

### TRANSMITTER MEASUREMENTS

| | |
|---|---|
| Power output – high (100%): | 130W |
| Power output – medium (50%): | 68W |
| Power output – low (10%): | 15W |
| 2nd harmonic output: | –75dBC |
| 3rd harmonic output: | –63dBC |
| Carrier suppression: | –40dBC |
| Sideband suppression: | –75dBC at 1kHz |
| Transmitter AF response at –6dB: | 220–2750Hz |
| Transmitter AF distortion: | <1% |
| Microphone input sensitivity: | 10mV (low), 4mV (high) |

NOTE: All signal input voltages given as PD across antenna terminal. Unless stated otherwise, all measurements made on SSB with the receiver preamp switched in (NOR) and operating from a 13.6V PSU. All two-tone transmitter intermodulation products quoted with respect to either originating tone.




## ACKNOWLEDGEMENTS

MY THANKS TO Kenwood (UK) for the loan of the equipment.

## REFERENCES

[1] 'Kenwood TS-50S Mobile HF Transceiver', Peter Hart, G3SJX, *RadCom*, May 1993, pp43-45.

***G3SJX***