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Kenwood TS-850S 160-10 Meter Transceiver

Reviewed by James W. ("Rus") Healy, NJ2L

When I started this review, I thought I could compare the TS-850S to the TS-950S (reviewed in January 1991 *QST*), expecting the '850 to be the '950's little brother. As it turns out, the TS-850S is significantly different—and in some areas considerably better—than the TS-950S.

What's New and Different

The TS-850S resembles the TS-950S at both the front-panel and circuit levels. What are the differences? Principally, the TS-850S has one receiver (the '950 has two); the '850 runs on externally supplied 13.8 V dc and puts out 100 W (the '950 uses an internal 120-V-ac-operated supply and puts out 150 W); and the '850 is considerably smaller, lighter and less expensive than the '950. One reason it's less expensive is that it's an *à la carte* radio—you pay extra for things that are standard on the '950, like the antenna tuner and power supply.

A quick look at the radio and instruction manual show that the '850 is, somewhat surprisingly, a newer-generation radio than the TS-950S. The TS-850S's synthesizer is particularly noteworthy. On receive, the '850 gives the operator almost *no clues* that it's a synthesized radio, especially when used on CW at its 1-kHz-per-revolution tuning rate (where the radio tunes in *1-Hz* steps). Very few synthesizer artifacts appear in the receiver; only *one* birdie exists in *any* ham band (it's at 29.494 MHz), and, like the TS-950S, the TS-850S has low composite transmitted noise (a combination of phase noise and broadband amplifier noise) and no discrete close-in spurs. Even with its very good synthesizer, the TS-950S isn't quite as clean as the '850 when it comes to synthesizer artifacts in the receiver.

The TS-850S's many customizable power-on function selections, although not new to this rig, offer a considerable improvement in ease of programming over the TS-950S. For instance, you can select the RIT/XIT range (±1.27 or 2.54 kHz); enable or disable the internal keyer's automatic-weighting function, the S meter's peak-hold function and the 10-Hz display digit; choose beep tones or CW messages to signify operational changes you make (or turn off the tones or CW messages altogether); and set the display to initially read **50**, **144** or **430** when you're using the rig as an IF for a transverter. Several other defaults are also changeable.

To use the power-on function selections, you turn on the radio while holding the **LSB/USB** key. On the frequency display, you'll see a numerical tag on the left, and **ON**, **OFF**, or some other descriptor to its right. The number signifies what parameter you're looking at; the value indicates its status. A chart in the manual shows the corresponding functions and numbers. Turning the **M.CH/VFO CH** knob dials through the 35 programmable functions, and the **UP/DOWN** keys change the selected function's status. For instance, to change the FSK shift from its default 170 Hz to 850 Hz, you turn on the rig (holding the **LSB/USB** key), dial up function 12, and press the **UP** button three times, stepping through 200 and 425 to 850. To record the change, press the **CLR** key, which exits the function-select mode, or turn the rig off and back on. All the functions can be easily reset to their default values, which are also enumerated in the manual.

In addition to its great synthesizer performance and extensive power-on function selections, the TS-850S sports several improved features and a friendly, pleasant front-panel layout. Also, the rig gives you a choice of the sideband on which you want to tune CW signals (more on this later) and sports a three-message memory keyer, an optional internal antenna tuner (like the TS-950S's tuner), three-speed AGC, and full-break-in CW operation. The TS-850S's internal computer interface is compatible with Kenwood's other computer-controllable radios, so it works with the same optional hardware interfaces and software as the earlier models.

Frequency Display, Control and Memories

In a departure from their traditional practice, Kenwood uses a liquid-crystal display (instead of a fluorescent-tube display) in the TS-850S. The display colors are the same as those of the '950, including the bar-graph meters. In receive, the rig displays signal strength; in transmit, it shows power output and ALC, SWR or speech-compression level. The display has a softness that makes it pleasant to read, and its two intensity settings let you compensate for ambient lighting conditions.

The TS-850S has no dedicated switch or buttons for band-changing, but instead gives you a choice of using the **UP/DOWN** buttons (which step you one band at a time through the ham bands, or in 500-kHz or 1-MHz increments), or the keypad to select bands. The '850's keypad frequency entry is easy to use and requires fewer keystrokes than almost any other radio that supports direct frequency entry. To select 7 MHz, for instance, you simply enter **ENT 7 ENT** and you're there. To get to 3.501 MHz, you key in **ENT 0 3 5 0 1 ENT**. When you change bands and later return via the **UP/DOWN** buttons to a band you left earlier, you'll return to the same frequency, mode, filter selections, and so forth, in the current VFO.

The '850 shares the '950's 100 memories, scanning and memory-manipulation schemes. Split-VFO operation, memory/VFO operation and front-panel placement of the keys that control these operations is also similar—and very convenient—on both rigs. The TS-850S's **M.CH/VFO CH** control works like the '950's: It tunes in 5- or 10-kHz increments and selects memory channels.

In addition to its 100 standard memories, the TS-850S also has a handy quick-memory feature. Two buttons to the lower left of the tuning knob—**M.IN** and **MR**—are placed in a box labeled **QUICK MEMO** on the front panel. When you tune across a station that you want to come back to, a single press of the **M.IN** button stores the VFO frequencies, mode, filter selection, RIT status, and other pertinent information. When you want to come back to that station, you press **MR**. If you're tuning for multipliers in a contest, this feature further helps by allowing you to store *five sets* of such information in a last-in, first-out fashion. Let's say you tune

Table 1
Kenwood TS-850S 160-10 Meter Transceiver, Serial no. 20800042

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 0.1-30 MHz; transmit, 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, and 28-29.7 MHz.	Receiver, 30 kHz-30 MHz; transmitter, as specified.
Modes of operation: AM, CW, FM, FSK, LSB, USB.	As specified.
Power requirement: 13.8 V dc at 2 A on receive with no signal; 20.5 A max on transmit.	Receive, 3 A max; transmit, 17.25 A max.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity (bandwidth not specified): SSB and CW, 10 dB S+N/N: 0.1-0.5 MHz, 0.2 μV (−121 dBm); 0.5-1.62 MHz, 4 μV (−95 dBm); 1.62-24.5 MHz, 0.2 μV (−121 dBm); 24.5-30 MHz, 0.13 μV (−125 dBm).	Minimum discernible signal (noise floor) with 500-Hz (1st IF) and 250-Hz (2nd IF) filters: 3.5 MHz, −143 dBm; 14 MHz, −141 dBm; 28 MHz, −145 dBm.
AM (10 dB S+N/N): 0.1-0.5 MHz, 2 μV (−101 dBm); 0.5-1.62 MHz, 32 μV (−77 dBm); 1.62-24.5 MHz, 2 μV (−101 dBm); 24.5-30 MHz, 1.3 μV (−105 dBm).	6-kHz IF filters, signal 30% modulated with a 1-kHz tone: 1.0 MHz, −98 dBm; 3.8 MHz, −122 dBm; 14.2 MHz, −121 dBm.
FM, 12 dB SINAD: 28-30 MHz, 0.25 μV (−119 dBm).	12-kHz filter, −123 dBm; 6-kHz filter, −124 dBm.
Receiver dynamic range (bandwidth, type and signal and spacing not specified): 108 dB.	Blocking dynamic range (500-Hz [1st IF] and 250-Hz [2nd IF] filters):* AIP off: 3.5 MHz, 141 dB; 14 MHz, 148 dB. AIP on: 3.5 MHz, >140 dB;† 14 MHz, >138 dB.†
	Two-tone, third-order intermodulation distortion dynamic range (500-Hz [2nd IF] and 250-Hz [3rd IF] filters):* AIP off: 3.5 MHz, 100 dB; 14 MHz, 99 dB. AIP on: 3.5 MHz, 99 dB; 14 MHz, 99 dB.
Third-order input intercept: Not specified.	AIP off: 3.5 MHz, 7 dBm; 14 MHz, 7.5 dBm. AIP on: 3.5 MHz, 15.5 dBm; 14 MHz, 17.5 dBm.
S-meter sensitivity (for S9 reading): Not specified.	31 μV (−77 dBm) at 14 MHz.
CW/SSB squelch sensitivity (1.62-30 MHz): Less than 2 μV.	As specified.
FM squelch sensitivity: Less than 0.25 μV.	As specified.
Notch-filter attenuation: More than 40 dB.	More than 30 dB.††
Receiver audio output: 1.5 W at 10% distortion with an 8-Ω load.	1.36 W at 10% total harmonic distortion (THD) with an 8-Ω load.
Receiver IF/audio response: Not specified.	At −6 dB: SSB, 160-2456 Hz; CW, 370-900 Hz (700-Hz offset, 500-Hz filters).
Transmitter	*Transmitter Dynamic Testing*
Transmitter power output: 100 W max on SSB, CW, FSK and FM; 40 W max on AM.	Output power: Continuously variable from 0 to 98-110 W (CW, SSB, FSK, FM—output is typically more than 100 W and varies slightly from band to band); AM, as specified.
Spurious-signal and harmonic suppression: More than 60 dB below peak power output.	As specified. See Fig 1.
Third-order intermodulation distortion products: Not specified.	See Fig 2.
CW-keying waveform: Not specified.	See Fig 3.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified	S1 signal, 18 ms; S9 signal, 19 ms; AGC off, 18 ms.
Composite transmitted noise 2-20 kHz from carrier: Not specified.	See Fig 4.

Size (height, width, depth): 5.3 × 13.3 × 14.8 inches; weight, 24 lb with internal antenna tuner (21 lb without).

*Blocking dynamic range and third-order IMD dynamic range measurements were made at the ARRL Lab standard signal spacing of 20 kHz.

†Dynamic range is greater than the indicated value. The input signal required to cause blocking exceeds the receiver's safe signal-handling limit. See text.

††Test-equipment limitations preclude ARRL Lab measurement of notches deeper than about 30 dB.

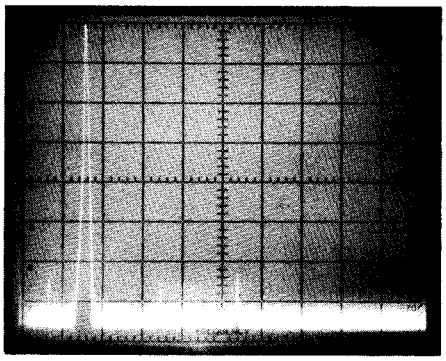


Fig 1—Kenwood TS-850S worst-case spectral display. Horizontal divisions are 1 MHz; vertical divisions are 10 dB. Output power is approximately 97 W at 1.9 MHz. All harmonics and spurious emissions are at least 64 dB below peak fundamental output. The TS-850S complies with current FCC specifications for spectral purity for equipment in this power-output class and frequency range.

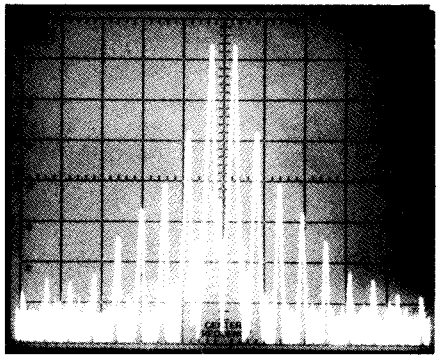
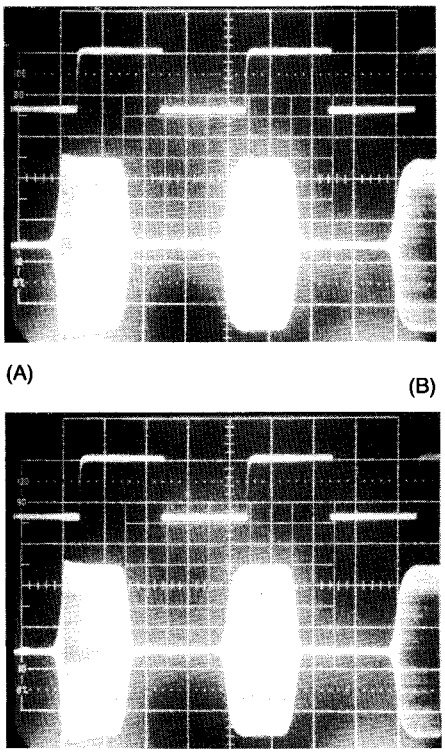


Fig 2—Worst-case spectral display of the TS-850S transmitter during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 28 dB below PEP output, and fifth-order products are approximately 40 dB down. Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The transceiver was being operated at rated output (100 W PEP) at 14.25 MHz.

across three stations you want to return to, and press the **M.IN** key when you're tuned to each one. You can recall the pertinent information by pressing the **MR** button and then turning the **M.CH/VFO CH** knob to select which of the three frequencies you want to be on. When selected, these memories are tunable, but when you leave **MR** mode, they revert to the originally stored settings. If you hit **M.IN** more than five times, only the last five sets of information remain stored. This system is such a boon to contest and DX operation that I can't imagine why I haven't seen it in this form until now (except in Ten-Tec's OMNI V, which has a similar one-memory system).



(A)

(B)

Fig 3—CW-keying waveforms for the TS-850S in the semi-break-in mode (A) and the full-break-in mode (B). The upper traces are the actual key closures; the lower traces are the RF envelopes. Horizontal divisions are 20 ms. The transceiver was being operated at 100 W output on 14.02 MHz. Other than a somewhat hard first keyed element (in both VOX and full-break-in modes), the TS-850S's CW keying shaping is excellent.

The Receiver

The TS-850S uses the same IF scheme as all of Kenwood's high-end transceivers since the TS-930S. IF-filter selection is similar to that in the TS-950S; two buttons to the left of the tuning knob select the filters for the 8.83-MHz and 455-kHz IFs, and indicators on the display show you which filters are selected. Kenwood limited to three the number of optional IF filters that can be installed in the '850, and, somewhat confusingly, also limited the icons displayed when filters are selected.

For instance, only one narrow CW filter (either Kenwood's 500- or 250-Hz unit) can be installed in the 455-kHz IF. The filter-indicator group for that IF has a **500** icon that's illuminated when the installed filter is selected. So, the **500** indicator simply shows which filter *slot* is selected—but it doesn't necessarily tell you the filter bandwidth, because either the 500- or 250-Hz filter may be installed there. Similarly, the 8.83-MHz IF has slots for two accessory filters, with **500** and **270** display indicators. Up to two of three accessory filters—1.8 kHz, 500 Hz and 270 Hz—can be installed in the available slots, though. Any of these filters can be installed in any of the three slots, but here again the display doesn't necessarily tell you what bandwidth you've chosen. This filter-indicator scheme can be confusing, but you still have the flexibility to select any filter combination you like on any mode except FM.

Instead of cluttering the front panel with a **PITCH** control (such as those on the TS-930S, -940S and -950S) to allow changing the CW offset and sidetone pitch, Kenwood implemented this feature in the TS-850S's software. A keypad button labeled **PITCH** brings up a display of the current CW offset in hertz (except during direct frequency entry). You select the desired offset, via the **M.CH/VFO CH** knob, in 50-Hz increments from 400 to 1000 Hz. A second poke of the **PITCH** button returns the frequency display, leaving you with the newly selected offset. Nice.

In a similar vein, Kenwood eliminated the **IF SHIFT** and **VBT** controls from the '850. Although this initially appears to be a serious weakness, it actually represents a significant improvement in operating ease—without a performance compromise. In place of these controls, which appeared on the TS-930S, -940S and -950S front panels, Kenwood has made the IF slope-tuning controls—previously effective only on SSB—functional on SSB, CW and FSK. The concentric **SLOPE TUNE** knobs allow changing the IF response independently from the high- and low-frequency sides, centering the IF passband where you want it, and narrowing the passband—all at the same time. And this scheme is effective, as I'll discuss a bit later.

In general, the TS-850S's AGC and received audio are excellent. The now-standard three-decay-speed AGC scheme provides maximum operator flexibility for varying band conditions and activities. A small AGC bug in the review radio reared its head late in the review period, however. With the AGC switched to the **FAST** position, very strong (S9-plus) CW signals caused AGC overshoot (brief but noticeable lack of AGC action). Switching the attenuator or AIP on, or changing the AGC decay speed to medium or slow, minimizes this effect by keeping the AGC time-constant capacitor(s) charged longer. According to Kenwood's Service Manager, Kenwood has received no previous complaints of this anomaly. Kenwood also could not reproduce this effect, nor could another TS-850S user I contacted, so this problem is apparently specific to the review rig.

Like the '950, the TS-850S has an **AIP** button that replaces the first RF-amplifier stage with a unity-gain stage that contributes to the receiver's excellent strong-signal-handling aptitude and increases its third-order input intercept. Like the Yaesu FT-1000D reviewed in March 1991 *QST*, with the AIP circuit on, the TS-850S doesn't block (limit gain) until the input-signal strength is so high that it could damage the receiver. Therefore, the table gives the blocking dynamic range at what we deemed the receiver's maximum safe input signal: 7 dBm (more than 5 mW). See the FT-1000D review for a more detailed explanation of this.

Unlike earlier Kenwood radios, the '850 has two RF-attenuator buttons: **6 dB** and **12 dB**. They can be used separately, and when both are pressed, 18 dB of attenuation is placed in line with the receiver input. Although it's operationally different from Kenwood's earlier rigs, this attenuator scheme is as useful as a single selector switch but clutters the front panel less.

The '850's noise blankers operationally resemble those on Kenwood's top-end radios as far back as the TS-830S. Blanker performance, though, isn't up to snuff with the earlier rigs; the pulse-noise blanker is more susceptible to overload from strong off-frequency signals and is less effective at getting rid of pulse-type noise than that in the '950. (The rig's "woodpecker" blanker, designed to reduce over-the-horizon radar signals, doesn't see much use, as such radars are rare in the ham bands these days.)

The Transmitter

In CW operation, the '850's transmitter performs very well. The internal memory keyer—a first for the major manufacturers—provides three messages of 50 characters each that can be chained together on playback, if you like. The rig's CW-keying waveform shapes are exemplary. At key closure in both QSK and semi-break-in operation, the first keyed element is a bit hard on the rising edge, but there's essentially no difference between the keyed elements in QSK and semi-break-in modes. This is a big improvement over the TS-950S, and the '850's keying simply sounds great on the air, even at speeds of more than 40 words per minute.

On SSB, the transmitter uses Kenwood's proven RF speech processing and a new front-panel-selectable feature called *high boost*, which enhances high-frequency speech components for a crisper SSB signal. Although audio processed by this circuit is somewhat harsh to listen to in the rig's internal transmitted-signal monitor, it definitely improves signal intelligibility on the air. Some operators have had trouble with unamplified non-Kenwood microphones (such as Heil mikes) underdriving the '850's audio amplifier, but that wasn't a problem with my Heil mike and the review radio.

The TS-850S falls short of most other current radios when it comes to transmitted SSB-signal cleanliness. Because Kenwood chose to design the '850 for an external 13.8-V dc supply (presumably to make for easy portable operation), the transmitter's IMD performance is nowhere near that of the TS-930, -940 and -950, which all use higher-voltage finals, at its rated output. (The '950's third-order IMD products are 12 dB better at rated output.) Running the rig

at power levels necessary to drive high-gain amplifiers using 3CX800A7 or 8877 tubes, the audio is plenty clean; at its 100-W rated output, though, transmitter IMD widens the TS-850S's transmitted SSB signals.

Options and Documentation

Adding IF filters to the TS-850S couldn't be much easier. You don't even need to remove the cabinet covers—you simply open a small hatch on the bottom of the rig, plug in the filter(s), replace the hatch, and flip the appropriate switches under another hatch atop the rig. Done. The optional DRU-2 digital voice recorder/player is similarly easy to install, but it mounts under the hatch atop the rig via three screws and three connectors to the adjacent PC board. Kenwood's voice-synthesizer option also fits under this cover, which, incidentally, has sliding catches—not the fingernail-splitting catches on the TS-930S, TS-940S, ICOM IC-765 and some other rigs. The manual clearly illustrates option installation with a bit of text and the usual clear graphics.

The optional DRU-2, when installed, provides three message memories for SSB operation. You select the message lengths via power-on selections. Unfortunately, the DRU-2 does not mute microphone audio during message playback. Although the service manual says that the DRU-2 is capable of recording receiver audio, the instruction manual doesn't mention this. A call to Kenwood's Service Department revealed that the DRU-2 can record received signals only by acoustical coupling.

The DRU-2 voice recorder/player we reviewed has either too much microphone gain or a too-high output level that overdrives the radio and introduces substantial noise on recorded voice signals. At present, the only way around this is to adjust the mike gain between message recording and live/playback transmissions.

To operate the TS-850S as a tunable IF for a VHF/UHF/microwave transverter, you remove the rig's bottom cover, move an internal jumper, apply 8-12 V dc to the **IF OUT** connector, and, if you like, reset the frequency display for 50, 144, or 432 MHz. Connect the receive converter's output to the **ANT**enna jack. According to the manual, when the rig is configured this way, the **IF OUT** phono jack provides 0 to 10 dBm of drive (adjustable from the front panel). (The review rig's low-level output is adjustable from −35 to 17.7 dBm.) Be *very careful* if you use the '850 for this application, though, because the presence of 8-12 V dc on the **IF OUT** connector is the only thing that keeps you from transmitting full RF output into the receive converter!

To use the rig for MF/HF operation with an accessory connected to the **IF OUT** jack, you must relocate the internal jumper. Kenwood could have made it much more convenient for VHF/UHF operators who want to take advantage of the TS-850S's excellent receiver as an IF for the higher bands by including a separate transverter interface like those on many of Kenwood's earlier radios. This would also have eliminated the risk of damaging the receive converter.

DSP-100 Digital Signal Processor

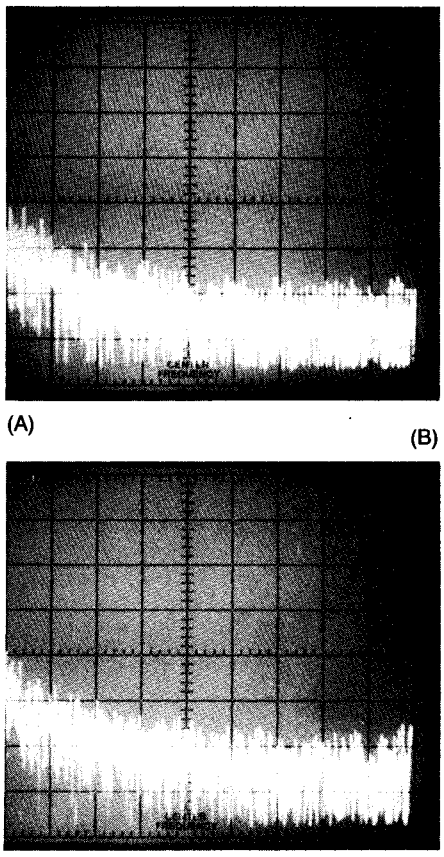
The costliest option Kenwood presently makes specifically for the TS-850S is the $630 (list) DSP-100 digital-signal-processing unit. The DSP-100 attaches to the rig via four cables and processes received and transmitted signals (either or both). Using DIP switches for configuration, the DSP unit provides receiver-audio filtering and transmitted-signal processing (keying shaping on CW, high- and low-audio-frequency cutoff adjustments on SSB, and carrier generation on FSK, AM and FM). The DSP-100's front-panel controls allow you to select the high- and low-frequency receiver-audio cutoffs, and those of the transmitted-SSB passband. These controls (especially the low-frequency cutoff) are effective on receive, but the transmitted-SSB-signal shaping doesn't make much difference in intelligibility, according to other operators. When the DSP-100 is in use on transmit, its **CAR LEVEL** and **MIC GAIN** controls override those on the transceiver.

In addition to audio shaping, the DSP-100 shapes transmitted CW signals, providing selectable rise/fall times of 2 ms or 4 ms via its front-panel **CW FAST/SLOW** switch. Internal switch settings let you change these times to 6 ms and 8 ms, respectively, although instruction manual warns that the 8-ms setting is too slow for QSK CW operation. In the lab, we found that the DSP-100-generated waveforms are well shaped. The DSP-100 keyed elements closely match the length of the stock rig's CW keying. The DSP-100 has no effect on the hardness of the first keyed element (see Fig 3).

Because the TS-850S does a fine job of generating good CW keying and intelligible transmitter audio, the DSP-100's only practical use to me was as a received-signal filter that helps eliminate some annoying low-frequency signals under crowded band conditions. The **SLOPE TUNE** controls work so well, though, that even this characteristic is of limited practical value.

The Manuals

The '850 comes with an instruction manual and a computer-control manual that describes the serial-data command structure. The instruction manual does the usual good job of describing connector pinouts and such, and, although it suffers from a somewhat weak translation from the Japanese, it's generally easy to understand. Overall, the 75-page manual is better than those of earlier Kenwood radios. One particularly useful aspect of the instruction manual is its one-page-per-mode operation descriptions: Separate fold-out pages describe transceiver use in SSB, CW, FSK, AM and FM. Also, front-panel areas and functions are briefly described, with references to the appropriate pages in the manual for detailed operating instructions.



(A) (B)

Fig 4—Spectral display of the TS-850S transmitter output during composite-noise testing. Power output is 100 W at 3.52 MHz (A) and 100 W at 14.02 MHz (B). Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The scale on the spectrum analyzer on which these photos were taken is calibrated so that the log reference level (the top horizontal line on the scale) represents −60 dBc/Hz and the baseline is −140 dBc/Hz. Composite-noise levels between −60 and −140 dBc/Hz may be read directly from the photographs. The carrier, off the left edge of the photographs, is not shown. These photographs show composite transmitted noise at frequencies 2 to 20 kHz offset from the carrier.

On the Air

I discovered how good the '850's receiver is when I used the rig on 40 meters in the ARRL CW DX contest in February. Conditions were excellent, and even on a band thick with incredibly strong signals, the receiver never faltered. The optional 500-Hz CW filters (we later installed the 250-Hz filter) and the IF slope tuning very effectively isolated weak signals from QRM. The rig's 1-kHz-per-revolution tuning rate (enabled by the **FINE** key) is perfect for scouring a crowded band. One really valuable TS-850S first is the ability to choose the sideband on which you want to receive CW, which is terrific under crowded band con-

ditions. If an interfering signal is too close to you on one side, simply switch from one sideband to the other! This feature works so well that I'd be surprised if other manufacturers don't adopt it, too.

Kenwood's hallmark smooth controls and great front-panel layout give the radio a high-quality feel that helped me keep my sanity during DX contests. Perhaps best of all, high-performance-oriented as it is, the '850 is intuitive and really easy to use—you don't need to keep the manual nearby when you're operating the rig.

The TS-850S is one of the best CW contesting/DXing radios on the market—in any price range. For SSB, it's not quite in the same class. Transmit-audio IMD is substandard, and the receiver's stock IF selectivity is sometimes inadequate for operating in crowded bands, even with the **SLOPE TUNE** adjusted for a relatively narrow passband. The optional 1.8-kHz SSB filter is a must for contesting, as we found at K1KI in the 1991 ARRL DX contest, where the review rig was used at the main operating position. In the course of more than 2500 contacts, we felt that we'd have been able to hear better with the optional 1.8-kHz SSB filter.

Rough Edges

One painful omission from the TS-850S is an external-receive-antenna input. The only way to connect a separate receive antenna to the radio is via an external switch of some sort, which is extremely inconvenient. If I bought a TS-850S, this is the first thing I'd change. In addition to a receive antenna, I'd use the new input jack for a transverter input that couldn't be accidentally transmitted into. Transverter operation and external receive antennas have become so common that an easy and safe means of connecting them really should be standard on all modern transceivers.

The TS-850S's **RIT/XIT** knob is a small one-turn potentiometer—not an optically encoded, reasonably large control like those of the TS-930, -940 and -950. This knob has no center detent, and there's no quick way to clear the offset (other than turning it off). I found this annoying, particularly during contests.

The rig's liquid-crystal display is clear and sharp dead-on, but contrast wanes past 30 degrees or so from directly ahead. This effect is visible in some of Kenwood's TS-850S advertisements.

The '850's **TUNE** function provides an unadjustable 50 W output, intended for use when tuning an external power amplifier. This is fine on CW, but on SSB, tuning an amplifier at half-drive will cause distortion and splatter when the amplifier is operated at full power. Tuning an amplifier for good linearity requires full drive power.[1] Pressing **TUNE** in CW also moves the transceiver's beat-frequency oscillator to IF center. For signals tuned to the proper receiving pitch (the pitch selected by means of the transceiver's **PITCH** function) this "outputs a zero beat" (as the manual puts it). In other words, if you've set the transceiver pitch to 450 Hz and tuned in an incoming signal for a 450-Hz note, pressing **TUNE** changes the receive pitch to 0 Hz. This is more of an artifact than a feature: I can't hear (and the rig's audio system can't reproduce) 0 Hz, so keying the rig's sidetone and leaving the BFO where it belongs would make more sense to me. It's easier to match two signals at, say, 450 Hz than it is to match two signals at 0 Hz.

The VOX controls, as well as the internal/external keyer and amplifier key-line switches, are on the rig's back panel. This makes adjustments difficult once the radio is installed in your station.

Receiver sensitivity in the AM broadcast band is reduced because of a 24-dB attenuator that's switched into the receive line on this band, probably to reduce the chance of overload from strong local broadcast stations. Less attenuation would make the receiver more useful to those interested in broadcast-band DX listening.

The Big Picture

The TS-850S has several personalities. Its basic radio performance and smoothly integrated interference-fighting features make it a joy to use for contesting and DXing, and its light weight and dc-supply requirements make it suitable for DXpeditions and portable operation. With its internal keyer, optional antenna tuner and digital voice recorder/player, the TS-850S is truly a station in a box; all you need to carry is the '850, a power supply, antenna, keyer paddles and microphone.

The TS-850S is a great value for its receiver alone—but when you consider all of its features, it's even better. In a nutshell, Kenwood kept the best of the TS-950S's features, added some great new ones, and trimmed the package down to a size that's more suitable for portable operation—generally without compromising performance. And for the price, nothing else even comes close to the TS-850S's performance.

A team of fine operators contributed to this review. Thanks to Steve Powlishen, K1FO; Dave Newkirk, WJ1Z; Chet Slabinski, N8RA; Mark Wilson, AA2Z; Tom Frenaye, K1KI; Rich Assarabowski, K1CC; Jim Parise, KC1SJ; and Jack Schuster, W1WEF.

Manufacturer's suggested retail prices: TS-850S with MC-43S hand-held microphone, $1699.95; PS-50 13.8-V power supply, $249.95; AT-850 internal antenna tuner, $205.95; YK-88SN-1 1.8-kHz filter, $84.95; YK-88C-1 500-Hz filter, $98.95; YK-88CN-1 270-Hz filter, $84.95; YG-455C-1 500-Hz filter, $149.95; YG-455CN-1 250-Hz filter, $159.95; YK-88A-1 6-kHz AM filter, $88.95; DRU-2 digital voice recorder/player, $121.95; DSP-100 digital-signal-processing unit, $629.95; SO-2 temperature-compensated reference oscillator, $149.95. Manufactured by Kenwood USA Corp, 2201 E Dominguez St, Long Beach, CA 90801-5745, tel 213-639-4200.

[1]See R. Measures, "Amplifier-Driver Compatibility," *QST*, Apr 1989, pp 17, 18 and 20.

SOLICITATION FOR PRODUCT REVIEW EQUIPMENT BIDS

[In order to present the most objective reviews, ARRL purchases equipment off the shelf from Amateur Radio dealers. ARRL receives no remuneration from anyone involved with the sale or manufacture of items presented in the Product Review or New Products columns. —*Ed.*]

The ARRL-purchased Product Review equipment listed below is for sale to the highest bidder. Prices quoted are minimum acceptable bids, and are discounted from the purchase prices.

Command Technologies Commander HF-2500 linear amplifier (see Product Review, May 1991 *QST*). Minimum bid: $1653.

Kenwood TS-790A triband VHF/UHF transceiver with optional UT-10 1240- to 1300-MHz unit and PS-31 power supply (see Product Review, April 1991 *QST*). Sold as a package only. Minimum bid: $2100.

Alinco DJ-560T 144/440-MHz hand-held transceiver (see Product Review, June 1991 *QST*). Minimum bid: $274.

ICOM IC-32AT 144/440-MHz hand-held transceiver (see Product Review, June 1991 *QST*). Minimum bid: $374.

Kenwood TH-77 144/440-MHz hand-held transceiver (see Product Review, June 1991 *QST*). Minimum bid: $356.

Standard C228A 144/220-MHz hand-held transceiver (see Product Review, June 1991 *QST*). Minimum bid: $439.

Sealed bids must be submitted by mail and must be postmarked on or before July 27, 1991. Bids postmarked after the closing date will not be considered. Bids will be opened seven days after the closing postmark date. In the case of equal high bids, the high bid bearing the earliest postmark will be declared the successful bidder.

In your bid, please clearly identify the item you are bidding on, using the manufacturer's name, model number, or other identification number, if specified. Each item requires a separate bid and envelope. Shipping charges will be paid by the successful bidder, FOB Newington. The successful bidder will be advised by mail. No other notifications will be made, and no information will be given to anyone regarding final price or identity of the successful bidder.

Please send bids to Bob Boucher, Product Review Bids, ARRL, 225 Main St, Newington, CT 06111.