

# CQ REVIEWS:

## The Yaesu FT-890 HF Transceiver

BY JOHN J. SCHULTZ\*, W4FA

**Y**aesu describes the FT-890 as the "world's smallest high-performance mobile" transceiver. Well, it is certainly true that the FT-890 is compact, and it does claim to incorporate in one package a host of features not available in other compact HF transceivers—for example, modern low-noise circuitry, dual VFOs for each band, 32 tunable memories, general-coverage receive, AF speech processing with audio response tailoring, built-in keyer, and a built-in automatic antenna tuner! Although Yaesu refers to the FT-890 as a mobile transceiver, it definitely represents a new-generation compact HF transceiver that is really suited for any portable, mobile, or fixed-station application. The FT-890 does have some innovative circuitry, but its real genesis lies in putting an unusually broad array of features into a very compact HF transceiver package.

Well, since I've already used the word "compact" a few times, its meaning deserves some quick clarification. I don't know if the FT-890 is the "world's smallest." Considering all of its built-in features, the statement is probably true. Considering that the FT-890 has so many built-in features, can be comfortably manually tuned, and has easily viewable frequency, meter, and control displays, it's a notable achievement in a "compact" transceiver design.

### Specifications

Table I shows the specifications for the FT-890. They are not quite as "dry" as they look, although you do have to slowly read through them to appreciate their scope. The physical and electrical characteristics are clearly described.

Some of the more interesting electrical specifications include that for the transmitter duty cycle, shaped SSB audio response, the automatic antenna tuner's impedance range, and on the receive side, the excellent IF/Image rejection figures and the excellent shape factor of the standard SSB/CW, wide/AM, narrow/IF filter.

I didn't try to vigorously check every specification, but I did check out a sam-



*The front panel of the FT-890 contains a fair number of controls and pushbutton fields, but it's a nicely balanced arrangement for such a compact transceiver.*

pling and I feel they are conservatively correct.

### Operational Features

The FT-890 is a very sophisticated transceiver. However, the designer of any transceiver faces an enormous challenge in trying to present the features of a sophisticated transceiver to the user. The front-panel layout/controls are pretty much the key to the situation. We all like the sophisticated features of the newer transceivers, but the front-panel layout/controls have to be very strongly "user-friendly" if we are going to enjoy a given radio.

The front-panel layout of the FT-890 strikes a nice balance. The knobs the user is likely to use frequently (main tuning, gain controls, and selectivity controls) are nicely dimensioned. Then there are several fields of pushbuttons which allow access to all sorts of functions. Generally, the pushbuttons to the left of the main tuning allow for mode selection, meter function selection (ALC, power output, or automatic SWR readout), processor on/off, AGC time constant, etc. The pushbuttons to the right all have to do with frequency manipulation except for two, which control the built-in

automatic antenna tuner. The controls for the built-in keyer are on top. "Power-up" customizing of various features seems to be standard on most sophisticated transceivers these days, and the FT-890 is no exception.

Table II presents the FT-890's menus. Actually, they are worth a bit of study, since they summarize various features that would be too tedious to detail in the basic specifications for a transceiver. As can be seen, the tuning rate can be changed, BFO offset displayed, speech-processor IF offset varied, scan modes changed, etc. The FM mode has been well treated. Repeater shift can be varied up to 200 kHz and any CTCSS tone from 67.0 to 250.3 Hz selected.

The FT-890 can be readily used for digital modes and computer control used to remotely handle practically any feature on the transceiver. However, Yaesu, much to their credit, does note that the optional 500 Hz narrow CW filter is not available for reception in the SSB modes needed for AFSK transmission. The 2.2 or 2.4 kHz SSB bandwidths will work, of course, but are not optimum for receiving narrow-shift AFSK.

The FT-890 has a wide variety of frequency setting/manipulation possibilities besides just turning the main tuning knob.

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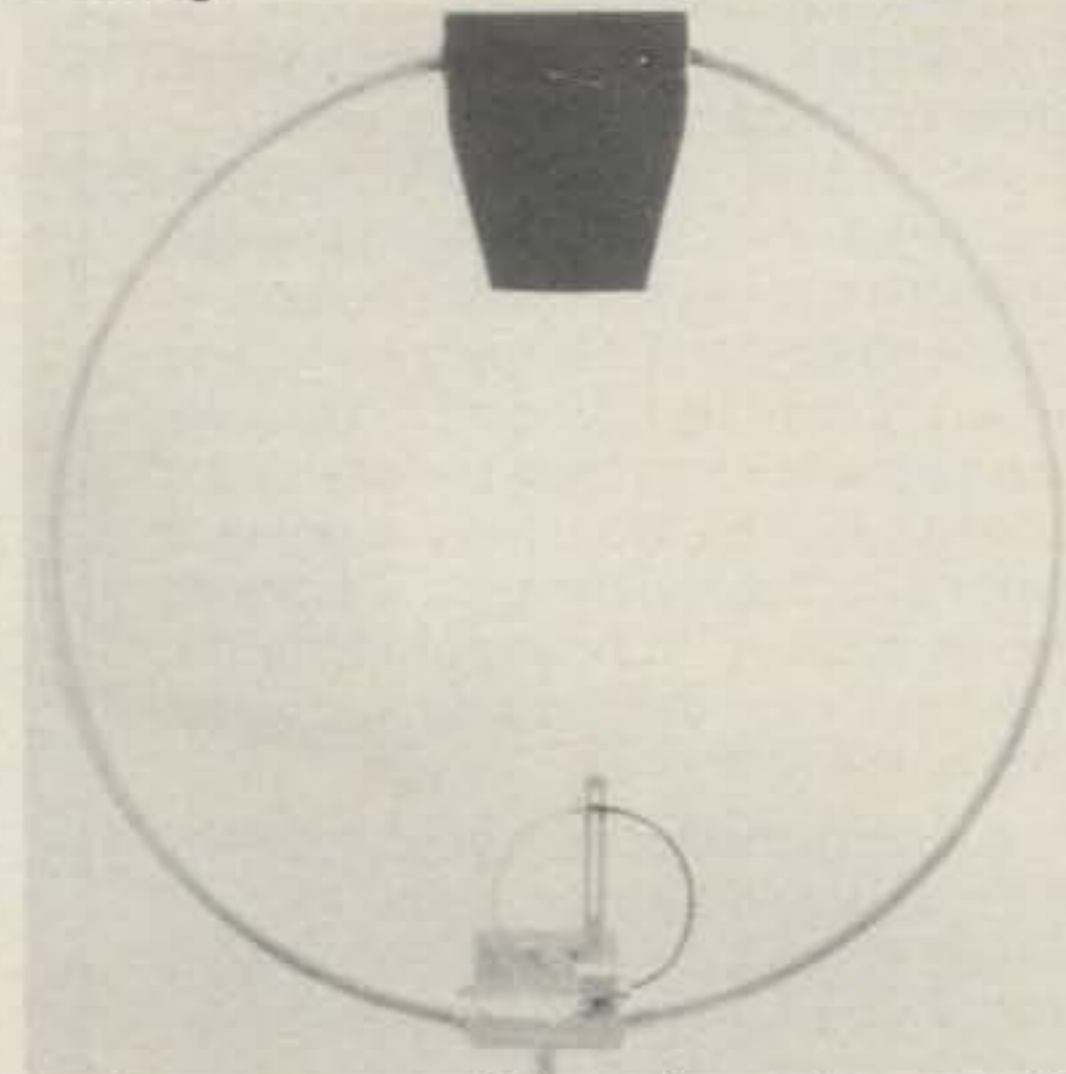


# MFJ Super Hi-Q Loop™ Antenna

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- Only 36" diameter but covers 10-30 MHz
- Round conductor more efficient than flat strip
- No control cable needed
- All welded construction
- Welded butterfly capacitor, no rotating contacts
- Automatic Band Selection™, SWR/Wattmeter

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**Reason 2.** It's built like a tank -- 1.050 inch diameter, thick wall aluminum radiator, all welded construction, no mechanical joints,

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**Reason 3.** You don't need a separate control cable -- the coax feedline carries both RF power and tuning control signals. The feedline is decoupled and isolated by a balanced to unbalanced transformer (balun) so the feedline does not radiate.

**Reason 4.** MFJ's exclusive Automatic Band Selection™ auto-tunes to your desired band and lets you know with a beep.

**Reason 5.** Dual Fast and Slow tune push buttons make the remote control much simpler to use.

**Reason 6.** A Cross-needle SWR/Wattmeter with two ranges is built into the remote control.

**Reason 7.** The remote control is completely self-contained because it

because most of the strip carries very little current ... it is not the amount of conductor surface that determines the resistance to alternating current, but rather the way in which the conductor material is arranged."

**Fact:** A large round conductor has much less RF resistance than a thin flat strip.

Because the MFJ Super Hi-Q Loop™ uses a large 1.050 inch diameter round conductor for its radiator -- not a thin flat strip -- it's more efficient. You radiate more precious power and waste less as heat.

## Remote Control (included) makes MFJ Super Hi-Q Loop™ easy-to-tune and extra portable



Super Loop™ Remote Control

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It's extra portable because ...

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... you don't need a separate SWR meter -- a two range Cross-Needle SWR/Wattmeter is built-in.

... you don't need a separate power cord because it's battery powered -- you can also use isolated 12VDC or 110 VDC with optional MFJ-1312B, \$12.95. 3¼x6x2½ inches.

uses internal AA batteries (not included). You can also use isolated 12 VDC or 110 VAC with MFJ-1312B, \$12.95

**Reason 8.** It's an incredibly low \$199.95 -- that's 40% less than the nearest competition.

**Reason 9.** You're protected by MFJ's famous No Matter What™ one year Unconditional Guarantee.

**Reason 10.** If you ever need help with your MFJ Super Hi-Q Loop™, you can call MFJ's exclusive toll-free technical help line 800-647-TECH(8324) and get expert help from a friendly MFJ Customer Service Technician.

## Round conductor has less RF resistance than flat conductor

The following is quoted from *Electronic and Radio Engineering* by Frederick Terman, 4th edition, page 22:

"... with a conductor consisting of a thin flat strip, ... the current flows primarily along the edges, ... the true or effective resistance will be high

## How can MFJ make the Super Hi-Q Loop™ so affordable?

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It would be impossible to describe all the possibilities, but they revolve around a total of 84 tunable *and* scannable memories. Two special memories accept frequency limits for scanning in case you wish to constantly scan a small segment of a band. Scanning can be made to stop when the squelch is opened or to stop and then proceed after a time delay. Frequencies can be transferred around between memories. There is no keypad frequency entry. The user has to start by tuning a VFO to a desired frequency and then transferring it around as desired. What are you going to do with 84 tunable memories? I have no specific answer. In hours of using the FT-890 I've only utilized perhaps a few dozen of the memories.

Speaking of memories, if you have read along a bit, you may have noticed that at the start of the article I mentioned dual VFOs for each band and 32 tunable memories. In the preceding paragraph I mentioned 84 tunable memories. How do those numbers add up? Well, I was rather confused at first, but the numbers are correct.

First of all, there are ten bands in the FT-890. Ten meters is split into two bands, the top one starting at 29.0 MHz, although it is not indicated in Table I. Therefore, two VFOs per band accounts for 20 memories. There are 32 tunable memories, *but* each memory has what Yaesu calls a front and back half, or what I would call a VFO A/B feature, since the front and back "halves" are accessed by means of the VFO A/B pushbutton. As long as any frequency placed into either half of any memory is within an amateur band, it can be used for transmission as well as reception directly without having to get back to one of the 20 amateur band memories. Therefore,  $2 \times 32 = 64$  and then add 20 and you get to 84!

When I first used the FT-890, I was too hung up on the dual VFO per band scheme used in the FT-1000, where you press a band pushbutton either once or twice to access either VFO A or VFO B for a given band. The FT-890 does not have a keypad, such as in the FT-1000, so obviously Yaesu had to use a different scheme. The scheme used is simple and straightforward, but I didn't catch on to it immediately simply because of my exposure to the FT-1000. In the FT-890, if you select A and then tune around any given amateur band, VFO A will return to the last used frequency on any one of the ten amateur bands. In effect, there are ten VFO A's. The same is true for VFO B. If you toggle between VFO A and B, the last used band frequency in either VFO is displayed. The frequency data for other bands is not lost when you tune around with either VFO on a given band.

The scheme allows great flexibility if you engage in split or crossband operation using VFO A/B setups, or if you simply want to check a given frequency on a band, by toggling the VFO A/B pushbutton, while continuing to operate on another band.

## General

Receiving frequency range: 100 kHz – 30 MHz

Transmitting frequency ranges:

160-m band, 1.8 to 2.0 MHz  
80-m band, 3.5 to 4.0 MHz  
40-m band, 7.0 to 7.5 MHz  
30-m band, 10.1 to 10.5 MHz  
20-m band, 14.0 to 14.5 MHz  
17-m band, 18.0 to 18.5 MHz  
15-m band, 21.0 to 21.5 MHz  
12-m band, 24.5 to 25.0 MHz  
10-m band, 28.0 to 29.7 MHz

Frequency stability:  $< \pm 10$  ppm, or  
 $< \pm 2$  ppm from  $-10$  to  $+50$  °C w/TCXO-3 option

Emission modes: LSB/USB (J3E), CW (A1A),  
AM (A3E), FM (F3E)

Basic frequency steps: 10 Hz for CW and SSB;  
100 Hz for AM and FM

Antenna impedance: 50 $\Omega$  nominal without ATU  
16.5 to 150 $\Omega$  with ATU (unbalanced)

Supply voltage:  
13.5-V DC  $\pm 10\%$ , negative ground

Power consumption (approx.):  
1.5 A receive (no signal)  
20 A transmit (100 watts)

Dimensions (WHD): 238 x 93 x 243 mm

Weight (approx.): 5.6 kg (12.3 lbs)

## Transmitter

Power output:  
adjustable up to 100 watts (25 watts AM carrier)

Duty cycle: 100% @ 100 watts PEP SSB

Modulation types:  
SSB: Balanced, filtered carrier  
AM: Low-level (early stage)  
FM: Variable reactance

Maximum FM deviation:  $\pm 2.5$  kHz

Harmonic radiation:  $> 50$  dB below peak output

Spurious radiation:  $> 40$  dB below peak output

SSB carrier suppression:  
 $> 40$  dB below peak output

Undesired sideband suppression:  
at least 50 dB below peak output

Audio response (SSB):  
not more than  $-6$  dB from 400 to 2600 Hz

3rd-Order IMD:  $-31$  dB typ. @ 100 W PEP, 14.2 MHz

Microphone impedance: 500 to 600  $\Omega$

## Receiver

Circuit type: dual-conversion superheterodyne

Intermediate frequencies:  
70.455 and 455 kHz, 8.215-MHz Notch IF

Sensitivity:  
(for 10 dB S/N, 0 dB $\mu$  = 1  $\mu$ V)

Frequency $\Rightarrow$ Mode (BW) $\Downarrow$	150 – 250 kHz (IPO on)	250 – 500 kHz (IPO off)	0.5 – 1.8 MHz (IPO off)	1.8 – 30 MHz (IPO off)
SSB, CW (2.4 kHz)	$< 5$ $\mu$ V	$< 2$ $\mu$ V	$< 1$ $\mu$ V	$< 0.25$ $\mu$ V
AM (6 kHz BW, 400-Hz, 30% mod)	$< 40$ $\mu$ V	$< 16$ $\mu$ V	$< 8$ $\mu$ V	$< 1$ $\mu$ V
29-MHz FM (for 12 dB SINAD)	—	—	—	$< 0.5$ $\mu$ V

Selectivity ( $-6/-60$  dB):

Modes	Minimum $-6$ dB BW	Maximum $-60$ dB BW
SSB, CW wide, AM narrow (without options)	2.2 kHz	4.2 kHz
SSB, CW wide, AM narrow w/YF-101 option	2.4 kHz	4.2 kHz
CW narrow with YF-100 option	500 Hz	1.8 kHz
CW narrow with XF-455K-251-01 option	250 Hz	700 Hz
AM (wide)	6 kHz	18 kHz

Squelch sensitivity:  
1.8 – 30 MHz (CW, SSB, AM):  $< 2.0$   $\mu$ V  
28 – 30 MHz (FM):  $< 0.32$   $\mu$ V

IF rejection (1.8 – 30 MHz): 70 dB or better

Image rejection (1.8 – 30 MHz): 70 dB or better

IF Shift range:  $\pm 1.2$  kHz

IF Notch filter attenuation: 30 dB or better

Clarifier tuning range/steps:  $\pm 9.99$  kHz/10 Hz

Maximum audio power output:  
at least 1.5 watts into 4  $\Omega$  with  $< 10\%$  THD

Audio output impedance: 4 to 8  $\Omega$

## Automatic Antenna Tuner Options

Impedance range: 16.7 – 150 $\Omega$  (unbalanced)

Frequency range: see Transmitting ranges, above

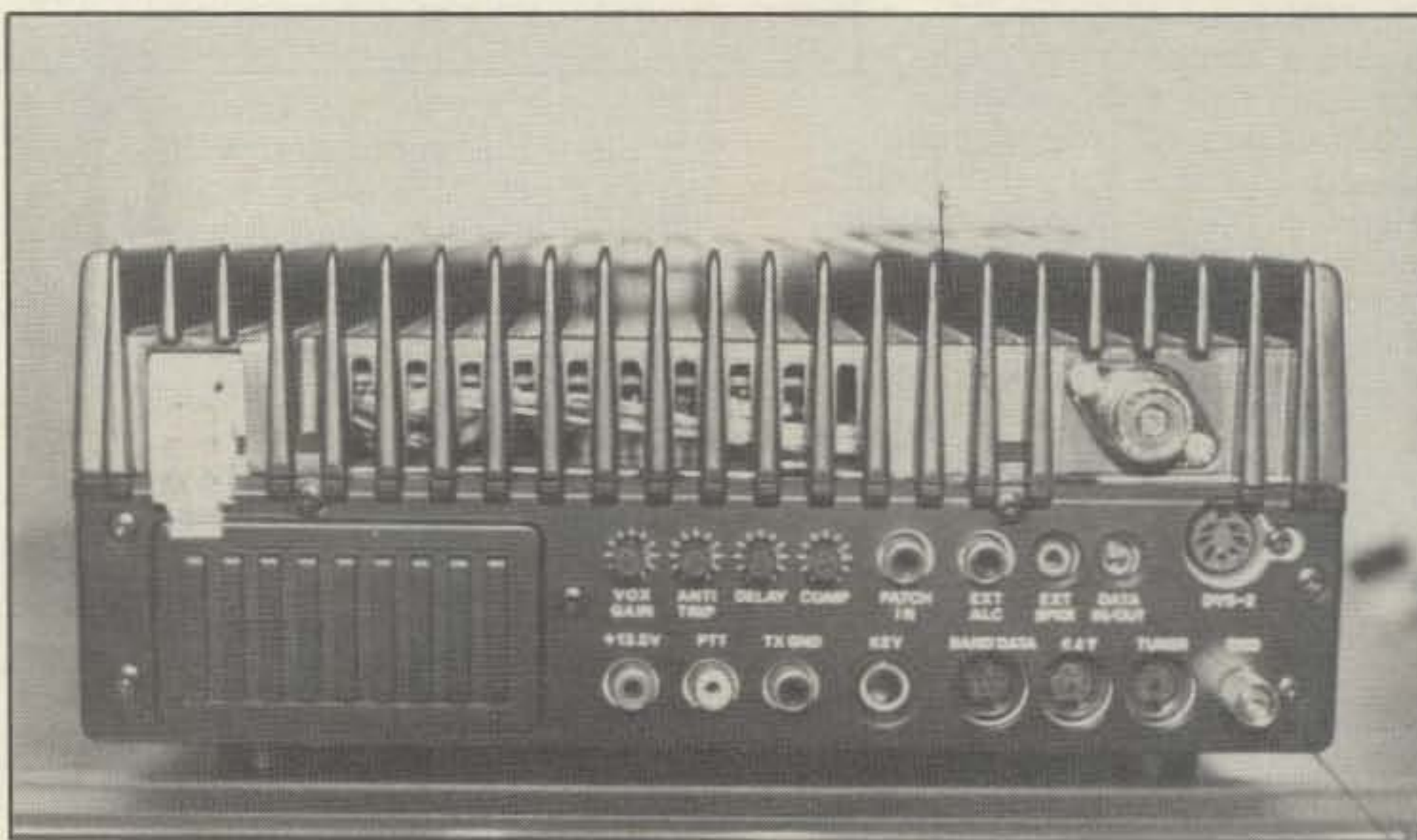
Min. auto-tune & Max. power range: 8 – 120 watts

SWR when matched: less than 1.4:1

Matching time: within 30 seconds

*Specifications are subject to change, in the interest of technical improvement, without notice or obligation.*

Table I—Specifications for the FT-890.



The rear panel contains some less frequently used controls plus connectors galore for just about any sort of external connection or control.



Power-Up Functions	Hold this button & turn on	Comments
Panel Button Beeper Enable/Disable	NOTCH	Press a button to see if the beeper is enabled.
Display BFO Offset or Carrier Frequency in CW mode	BAND/MEM DOWN	BFO Offset adds 700 Hz to displayed CW frequency. Affects display only.
Display 10-Hz Frequency Digit at right end of display, or Last Memory (toggle)	BAND/MEM UP	Affects display only.
Make FAST Button press-on/press-off, or active-only-while-pressed	FAST	FAST is displayed when active.
Adjust Repeater Shift (0 to 200 kHz, 100 kHz default). Press RPT/T again after setting.	RPT/T	Shift is displayed. Use tuning knob or DOWN/UP to change in 1-kHz steps.
Cause Clarifier to activate Memory Tune mode when operating on a memory (enable/disable)	NB	Disable to allow clarifier adjustment without automatic switching from Mem to Memory Tune.
Clear All Memories and return settings to factory defaults	HAM/GEN + CLAR	VFOs and Memory 1 default to 7.000 MHz LSB.
Scan Resume Mode: Always after 5-sec pause, or only after squelch closes.	VFO/M	There is always a pause after squelch closes before scanning resumes.
Select Lock Mode: Tuning Knob Only, or Knob & Buttons	LOCK	"Lock" blinks when buttons are locked. MOX and POWER cannot be locked.
Test all Display Segments, and Check Firmware Version	A/B + A=B	Display tests performed for 15 seconds, followed by ROM version number for 2 seconds, and return to normal.

FAST Button Combinations	Hold FAST button and press...	Comments
Set Beeper Audio Frequency (220 to 7000 Hz, 800 default). Press NOTCH again when done.	NOTCH	Repeating double beep sounds and beep frequency displayed in Hz while adjusting.
Display Brightness	Turn CLAR	Choose 1 of 8 levels.
Knob Tuning Rate Selection: toggle 5 & 50 or 10 & 100 kHz per turn	SWR	Affects Tuning Knob rate only: Steps are unaffected.
Speech Processor IF Offset Adjust ( $\pm 300$ Hz). Must be in an SSB or AM mode. Press PROC again when done.	PROC	Listen to your signal in an external receiver while adjusting.
Display/Select CTCSS Tone Frequency (from standard tones, default 88.5 Hz). Press RPT/T again when done.	RPT/T	Displays tone frequency in Hz. Use tuning knob or DOWN/UP buttons to select.
Toggle Current Memory to be skipped when Memory Scanning (skip/no-skip)	VFO/M	Affects only memory scanning. "SKIP" displayed when activated.

Table II—Power-up settings.

## Using the FT-890

In spite of its sophistication, the FT-890 is a relatively easy transceiver to operate and has excellent receive/transmit characteristics.

On the receive side, it has one of the quietest receivers I have heard. Tuning is very smooth, and the fact that the tuning speed can be varied and the various possibilities for quickly stepping the received frequencies in 100 kHz or 1 MHz steps make things easy to adjust. I did not really miss a keypad for frequency entry. The selectivity controls (notch and shift) provide enough flexibility for most QRM situations. The optional 500 Hz CW filter is excellent and just about a "must" for any CW fan. I didn't have a chance to test the optional SSB filter, but I suspect it could be very useful if the FT-890 is to become the main station rig. The built-in 2 1/2 inch loudspeaker provides tolerable audio quality, but I sup-

pose there was just not enough space available to provide much else.

As was mentioned before, the memory possibilities are rather enormous, but it really is a case of using as much or as little as you desire. The basic memory functions are clearly laid out, but you do have to have the manual, or a crib sheet, handy to get into the more advanced memory/scanning functions.

On the transmit side, the FT-890 will provide a clean 100 watts output on all bands. The internal cooling fan did cycle on and off at times, but it has a low noise level. On SSB and AM (!) you can easily tailor your transmit audio by means of the carrier point adjustment provided. The offset (which can be displayed on the readout) can be set between -300 Hz and +500 Hz independently for LSB and USB and between -3 kHz and +3 kHz for AM. I ended up with a +250 Hz SSB setting and received excellent reports. The adjustment

involves a trial-and-error process, but is surely worth the effort. The processor compression level is set by a rear-panel control. I would suggest leaving it at the factory setting rather than trying to "squeeze out" another dB or so of processing.

On CW the built-in keyer performed smoother than I had expected. The 1/2 inch or so of travel on the speed control appears small, but the control is not difficult to adjust. Full and semi break-in worked smoothly. Weighting can be set at 1:3 or 1:4.5 (dot: dash) by the external controls. The sidetone pitch cannot be adjusted. For those who might be interested in QRP CW, the power-level control allows the output carrier power to be varied down to about 3 watts. Battery operation of the FT-890 is quite possible, and I did try it with a 12 V/6 A.H. "Gel-Cell" rechargeable pack. The limiting factor becomes the constant, relatively high current drain during receive periods.

The automatic antenna tuner is one of the fastest available and has a generous matching range which exceeds that shown in Table I, especially on the high impedance side. I did have it loaded, with 100 watts power output being indicated, into a plain 6 foot piece of wire on all bands except 160, 80, and 40 meters, but such usage borders on abuse of the unit. It is, however, an ideal unit if the FT-890 is being used in a mobile installation and you want to QSY beyond the normal bandwidth of the usual loaded, mobile whip antenna.

The RF circuitry of the tuner uses a conventional T network with a long inductor arm grounded at one end and two variable capacitors. The added "trick" is the relay switched capacitors which can be added across the individual variable capacitors or across the entire series combination of the two variable capacitors. I expect a few hundred more matching combinations were achieved by that "trick" as compared to a conventional T network. It's also easier on the variable capacitors.

Overall, I can't stop being impressed by the small size of the transceiver. It doesn't have every operating feature in the world, but it truly is a full-featured, compact HF transceiver that goes far beyond your basic bottom-of-the-line transceiver. It sort of invites you to pick it up by its carrying handle and take it along almost anywhere.

## Manual

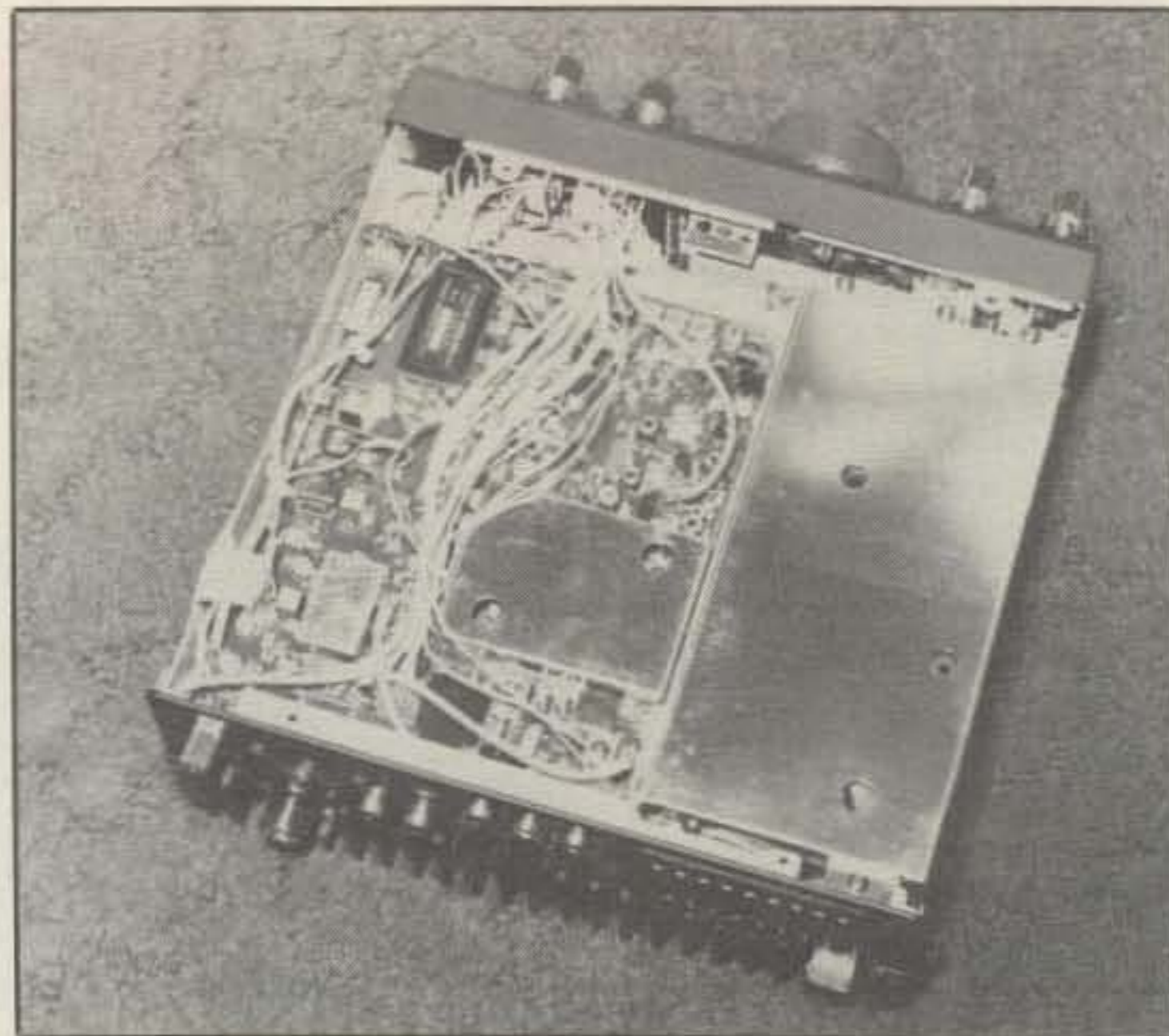
I'm impressed by well-written operating manuals. No matter how much sophistication the engineers put into a transceiver, it doesn't mean much unless someone can convey to you and me in fairly simple and clear terms how to use the features.

The manual for the FT-890 is very well written and very well organized with plenty of illustrations. If you just want to basically get the transceiver into operation, it is





*This top view shows the extremely large heatsink which is backed up by an internal fan. Air is sucked in from a vent on the rear panel and exits to the rear of the heatsink. The small internal speaker is obvious. To the left of it and towards the front panel are the top-mounted keyer controls.*



*Removing the bottom cover, you can see a large PC board and part of the shielding for the automatic antenna tuner (to the right). To the upper left of the PC board are the mounting spaces for the optional IF filters. The larger CW optional filter is installed to the right of the hardly visible, very small, standard ceramic SSB filter. The PC board has to be partially removed for a solder-type installation of the optional filters.*

only necessary to read a few pages. If you want to get into the details of using digital modes or computer control, there are detailed discussions.

### Power Supply

The FT-890 I tested was used with an FP-700 power supply. The FP-800 is the

heavy-duty power supply for the FT-890, but I didn't have one available at the time of this writing. Just on the basis of compatibility, I would suggest the use of the FP-800 power supply. It also contains a built-in speaker for improved receive audio.

A note of caution should be mentioned. The rear-panel power connector on the FT-890 is similar to that used on some oth-

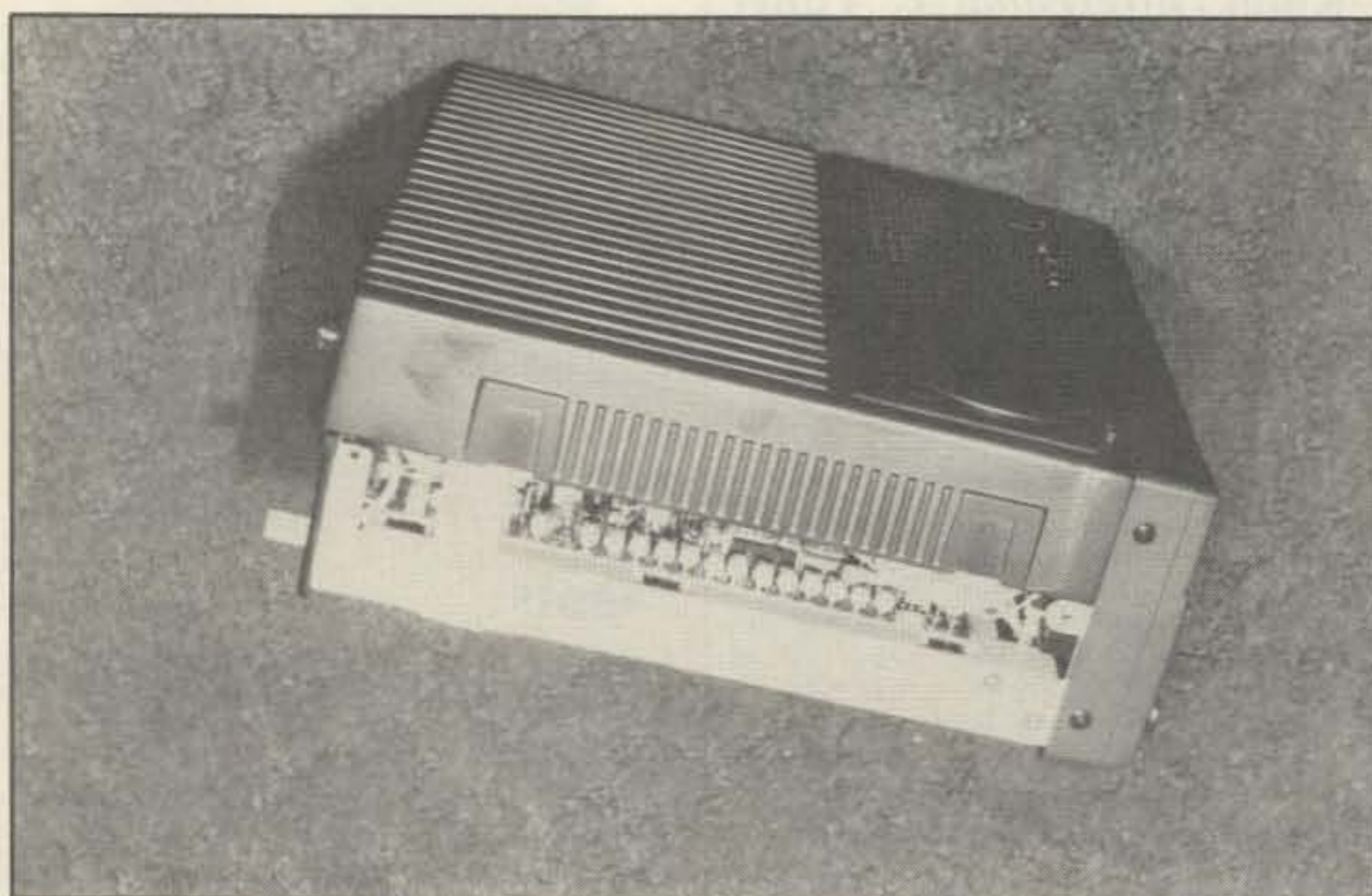
er transceivers. But the wiring may be different, especially where switching of the AC power line in the power supply by a front-panel switch in a transceiver is concerned. It seems a simple enough caveat, but if you are going to intermix different manufacturers' equipment which have similar connectors, check the connections! The power-supply connection of the FT-890 is absolutely simple and straightforward, but a few of the transceivers have apparently already been damaged by amateurs who thought similar power-supply connectors equate directly with interchangeability.

### Accessories

The FT-890 will interface with a very wide range of Yaesu accessory items including the DVS-2 digital voice recorder/playback module, which is a very handy item for contesting. The YF-100 500 Hz IF filter, YF-101 2.4 kHz IF filter, and TCXO-3 crystal oven are all dedicated accessories for the FT-890.

### Summary

The FT-890 is priced at \$1529.00 (with built-in antenna tuner). The FP-800 is \$299.00; DVS-2, \$299.00; YF-100, \$159.00; YF-101, \$159.00; and TCXO-3, \$99.00. Brochures are available from dealers or from Yaesu, USA, 17210 Edwards Rd., Cerritos, CA 90701.



*Since I had removed the bottom cover, I couldn't help but notice this array of 14+ trim pots on one side. Apparently it is intended to facilitate alignment/adjustment of the transceiver without having to access every individual PC board.*