

Yaesu FT-847 HF/VHF/UHF Multimode Transceiver

Yaesu's near "DC-to-light" FT-847 just might be the only rig you'll ever need. We put it to the test on a California mountaintop—one shared with a bunch of intermod-generating transmitters.

By Gordon West, WB6NOA*

The general product description of Yaesu's new FT-847 will certainly grab your attention: *Yaesu FT-847 LF/MF/HF/VHF/UHF Transceiver*. Reads much like "DC-to-Daylight," doesn't it? And what we found during our mountaintop tests was a rig that truly lived up to this name!

This rig has all of the bands built in—there are no additional band units necessary for 6 meters, 2 meters, or 70 centimeters—the VHF and UHF bands are fully integrated into the HF transceiver for one compact radio that does it all.

The FT-847 is *really* compact, measuring just 3-1/2 inches high, 10-1/4 inches wide, and 10-3/4 inches deep (see Photo A). I was expecting something a lot larger, but this transceiver is perfectly sized for mobile operation, yet has all of the "big knob" features that you would expect from base station equipment. It runs directly off of 12 volts DC, keeping the size and weight down to a minimum for portable Field-Day-type applications, and it uses the same Molex 12-volt plug and receptacle as that used on many other HF radios.

An externally placed power supply is required for 110-VAC use. Yaesu offers the FP-1030A, a 30-amp, heavyweight, transformer-type base station power supply; or, for traveling, you could run the FP-1025A, a 25-amp switcher power supply. Both supplies would be placed next to, or down out of the way of, the transceiver. There is no provision (or

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Photo A. The compact FT-847 is the first commercially made radio to operate from 160 meters to 70 centimeters without the need for add-on modules. It offers 100 watts out on HF and 6 meters and 50 watts out on 2 meters and 70 centimeters. (WB6NOA Photo)

room!) to build in any type of 110-VAC supply on the inside of the radio.

The radio has four antenna jacks (see Photo B). There's one SO-239 connection on the rear for MF/HF (160 to 10 meters), and two additional SO-239s, one for 6 meters and the other for 2 meters. The fourth output is an N-type jack for 70 centimeters.

Frequency Coverage

When I say "DC-to-Daylight" frequency coverage, this radio comes closer than any other. For a rundown of what you get, straight out of the box, check out the "FT-847 Frequency Coverage" box on the next page.

According to the specifications, power output on high frequency and 6 meters is 100 watts SSB and 25 watts AM. I measured somewhat more power output than these minimum specs. FM output on both 10 and 6 meters was measured at 105 watts.

On 2 meters and 70 centimeters, the specs show 50 watts of SSB power output, and I saw slightly higher peaks during our field test. On FM, power output was measured at 55 to 57 watts.

Double Field Test

My first brief in-the-field operation of the Yaesu FT-847 took place during a very rainy Sunday afternoon while doing



Photo B. There are four separate antenna jacks on the back of the radio: one each for HF, 6 meters, 2 meters, and 70 centimeters. In the photo, Gordon is pointing to the computer control jack that allows the FT-847 to be used as a remote base. (K7JA photo)

a mobile loop antenna review down at the beach (see "Two-Meter Loop Shootout" in last month's issue). Chip Margelli, K7JA, Yaesu USA's Research and Development Manager, was able to score a demonstration unit in between ham shows, and he loaned it to me for the day's loop review with the proviso that I had to learn to run the equipment without an instruction manual (he hadn't finished writing it yet!).

Absolutely no problem. There was no mystery at all in getting everything up and running without looking at the book. Hit the power button, top left, crank the RF gain all the way clockwise, AF volume to 9 o'clock, band up to 2 meters, hit SSB, and start the loop review at 144.240 MHz after an initial announcement on the 144.200 calling frequency. An absolutely logical operation for getting started on simplex operation. I suppose there were a host of menu items that I could have adjusted, but for this brief and limited operation, no instruction manual was necessary.

The rig ran flawlessly in my mobile communications van down at the beach. But I needed a few more hours of "play time" with the FT-847 to really put it through its paces. So, a month later, Chip and his wife, Janet, WØMF, Manager of the Ham Radio Outlet store in Anaheim, California, came by with the 847 and a car full of homebrew weak-signal long Yagi antennas, and suggested we take the rig up to a local mountaintop where we could really put it through its paces (see Photos C and D). This particular hilltop was suggested by Yaesu's National Sales Manager, Kevin Karamanos, WD6DIH, as being a good location to bang a signal

on 2 meters and 430 MHz all the way up to the San Francisco Bay area, 300 miles away. Kevin also gave us a little bit of advice before we went behind the locked gates: "You may want to turn off all of your other radio equipment when you get to the top," he told us. It didn't take us long to figure out why.

Our operating position at the mountaintop—one of the tallest hills overlooking all of Southern California—was just 300 feet away from a triple-tower commercial/military repeater and microwave system. Kevin later told us that more than one ham has left this location with an HT that no longer worked, probably because of a burned up front-end transistor from all of the RF coming off the top of the hill. This would really put the FT-847's receiver to the test.

Contest-Style Setup

Our first job was assembling the antenna systems. Chip and Janet set up their 24-foot-long homebrew, 19.4-dB gain, 432-MHz long-boom Yagi and aimed it

in the general direction of San Francisco. I was trying out my new telescopic flagpole antenna system that anchors to the ground by driving over the lip of the receiving tube (see "Need a Portable Mast? Try a Telescoping Flagpole!" elsewhere in this issue). The flagpole, which collapses to 90 inches, and telescopes out to 20 feet with a 2-5/8-inch outside diameter, was stout enough not to flex in the wind. The 2-meter antenna I chose for this Yaesu test was the extremely lightweight Maspro 144 WH10 10-element Yagi, "spec"ed out at 9-dB forward gain. This is not a real common 2-meter weak-signal DXer's beam because of its modest gain and short boom length, but I like it because it's extremely lightweight and handles easily on our new telescoping flagpole mast (see "Resources").

For high frequency, the rig was tested on several base station three- and four-element tri-band Yagis, as well as mobile up at the mountaintop, using the Outbacker Outreach antenna. All coaxial feedlines were low-loss 9913-type, including a short run of LMR-400 coax, and 12-volt power was taken directly from the communications van's power system.

Intermod Tests First

The first test up at the mountaintop site was just to see whether the receiver was going to handle the kilowatts of ERP (Effective Radiated Power) hammering it from the nearby repeater towers. We didn't really know if there might be so much RF in the air that the receiver would be desensitized, or *desensed*, to incoming signals. To our amazement, the hillside was extremely clean of stray RF garbage, and reception on HF, VHF, and UHF bands was intermod-free. Most amazing! But we knew we were getting pounded because most of the other FM equipment in the vehicle was showing

FT-847 Frequency Coverage

Receive Capabilities

100 kHz–30 MHz
36 MHz–76 MHz
108 MHz–174 MHz
420 MHz–512 MHz

Transmit Capabilities

160–10 meters (+5167.5 kHz**)
6 meters
2 meters***
70 centimeters

** 5167.5 kHz is the State of Alaska distress frequency (see "Northern Exposure?")
*** It's likely that there will be mods for extended transmit for authorized members of CAP (Civil Air Patrol), MARS (Military Affiliate Radio System), and USCGA (U.S. Coast Guard Auxiliary). However, Yaesu will *not* comment on this.

absolutely full tilt on the S-meters with nothing but garbled conversations coming out of the speakers. Yet on the FT-847, interference was not encountered.

Next, we turned both beams toward the repeater transmitting station, and, sure enough, you could hear the noise floor rise on both 2 meters and 430 MHz, but both bands were still able to hear signals coming in from the back of the beam without any desense noticed.

According to Chip Margelli, this outstanding receiver performance is the result of a comprehensive effort to optimize strong-signal-handling performance, both with regard to out-of-band and in-band signals. "The engineers concentrated on a multi-tone IMD [intermodulation distortion] environment, not the simpler two-tone tests which do not reflect today's crowded bands," Chip explained, adding that "on 432 MHz, we even incorporated a High-Electron Mobility Transistor [HEMT] preamplifier, to ensure very low system noise figure." The HEMT preamplifier contributes to the rather remarkable sensitivity specification of .0125 mV for 10-dB S/N SSB bandwidth.

Transmit Tests

We made a quick call on 144.200, and instantly hooked up with W6OMF up in the Bay Area some 420 miles away, who was coming in at an astonishing S7 on the analog-looking LCD S-meter. Chip switched him up to 432, and—presto—signal levels were again in the 5/6-5/7 area. And when received signal levels would take a dip from the long-haul path, we switched on the adjustable digital signal processor (DSP), and were able to hold onto the signals, even if they dipped all the way down and into the noise. The DSP knob is located conveniently down in the lower right-hand corner of the transceiver (see Photo E), and you can adjust the knob with two fingers and push the individual buttons on and off with your third finger for digital filter, digital notch, and digital noise reduction that makes weak voice signals come in with a rolling sound; but, nonetheless, makes them much more copyable than without any DSP filtering at all.

"Where DSP really plays an important part in reception is working moonbounce as I did later on in the week with K5GW," commented Chip. "And this radio has enough power, with the right long Yagi, to hammer enough signal off the moon

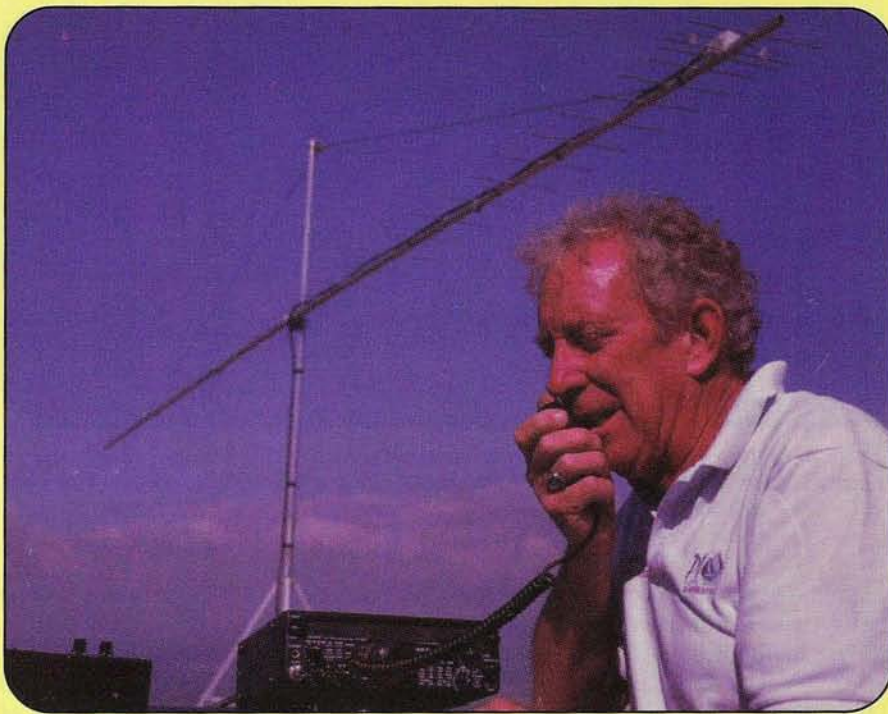


Photo C. The author field-testing the new Yaesu FT-847. There was no intermod or desense, despite the presence of very strong signals from nearby commercial transmitters. (K7JA Photo)

that another station with a big antenna system similar to K5GW could hear our signals," he added.

If you're planning this type of operation with the new FT-847, Janet Margelli suggests the optional 500-Hz Collins mechanical filter. "This filter is ideal for data signals, such as CW and RTTY," adds Janet. The Collins 500-Hz CW filter is front-panel selectable, and, when combined with the included DSP audio filters, the mechanical filter options make the FT-847 the ultimate rig for moonbounce and weak signal VHF/UHF work.

Satellites, Too

Our next test was to see how well the rig worked on satellite Mode A (Transmit on 145 MHz, Receive on 29 MHz), Mode B (TX 435 MHz, RX 145 MHz), Mode J (TX 145 MHz, RX 435 MHz), and Mode T (TX 21 MHz, RX 145 MHz). The radio provides independent displays of both uplink and downlink frequencies. Uplink and downlink normal and inverted VFO tracking is similar to what I've seen on the Yaesu FT-736R. This tracking feature in the FT-847 will slave the two VFOs according to the requirements of the satellite transponder. You can tune across the downlink subband without having to make manual uplink adjustments.

As an example, when we worked with RS-12, uplink and downlink frequencies track in the same direction. But for such satellites as AO-10, FO-20, and FO-29, full duplex operation and tracking require the VFO to move inverted—going higher on the uplink signals will cause the downlink frequency to shift lower. In addition, you can manually make minor Doppler-shift frequency corrections to either the transmit (uplink) or the receive (downlink) frequency. And we even discovered that we could label each of the 12 special satellite memories with alphanumeric tags to remember which satellite and what mode we were operating on!

I was most impressed with the very low noise floor on 70 centimeters as we waited for a pass of the AO-27 satellite to begin. The radio was nearly silent until the satellite came into view and its beacon just came out of nowhere.

For data operation over the satellites, a rear-panel data in/out and PKT jacks can accommodate 9600-bps GMSK, 1200-bps PSK, or 1200-bps AX.25 AFSK modes. I can't wait until the Phase 3D satellite gets up into space to really give this rig a workout! (GMSK, by the way, stands for Gaussian Minimum Shift Keying and is essentially what's produced by a G3RUH-style modem used for digital satellite contacts. PSK is Phase

Shift Keying, also used on some satellites, and AFSK is Audio Frequency Shift Keying, the modulation used for standard terrestrial packet.—ed.)

Exercising Your Fingers

Moving around the VHF and UHF bands (for that matter, all of the bands) is easy with the big tuning knob. Spin the knob and away you go. But if you need to really get to somewhere in a hurry, in behind the main knob is the unique Yaesu "Shuttle-Jog" tuning ring. This was introduced on the FT-1000MP and FT-920 HF radios. Get your fingers around the inside ring, rotate a little bit to the right, and zingo, up you go in frequency. Give it a little harder nudge to the right, and whamo, you're racing up the band in megahertz. I prefer to prowl around the band with the VFO channelized rotary switch encoder knob. This click-click-click knob lets me get around in tuning steps that I can actually feel. The step sizes may be changed via the menu, and are independent for each mode of operation, such as SSB/CW, AM, and FM. This allowed me to tune in 1-kHz steps on 2-meter SSB, but in 5-kHz steps on FM.

All the while, you watch the frequency on a massive LCD screen on which the big, bold numbers and metering system are easily seen in broad daylight, or in the dead of night. The screen has a blue electroluminescence lighting behind it, and you can dim it down to just where you want it for working those weak ones at 3 o'clock in the morning. Incidentally, for

the visually impaired, Yaesu offers a voice synthesizer (model FVS-1A) that announces the current operating frequency down to 100-Hz step resolution. There is also an adjustable beep level to suit your operating requirements when you're pushing away at all of those buttons.

Special CW Features

Since Chip is an avid weak-signal CW operator, you can be sure that the rig was developed around some very tight bandwidth requirements. Is 25 Hz sharp enough for you in the DSP mode, with 100 Hz, 200 Hz, or 400 Hz also available? The 847 has a built-in iambic electronic keyer with adjustable weighting, and it operates with semi-break-in T/R control. Either upper- or lower-side injection can be selected for CW reception; and, if you really want to get down to fine-tuning a weak CW signal, you can use the menu to get the VFO to track all the way down to $1/10$ th of a hertz tuning. Close enough?

Finally, for those of you into monitoring weak-signal propagation beacons, you'll enjoy the squelch *hysteresis* built into the FT-847. This smooth squelch action—a feature found only in a few VHF SSB transceivers, most notably the Kenwood TR-751, TR-851, the Yaesu FT-726 (but not the FT-736), and now the FT-847—allows you to silence the background noise, but still allow micro-weak signals or noise bursts to open the squelch.

Instead of a DC clamping squelch cir-

Northern Exposure?

Did you notice an unusual frequency—5167.5 kHz—in the specifications listed in the main text? This is a special allocation for amateurs operating in or within 50 nautical miles (92.6 kilometers) of the State of Alaska, and it is to be used only for emergency communications (protection of human life or property). It's almost unknown and virtually unused because practically no ham gear has been able to transmit there. But a menu on the FT-847 allows you to enable this frequency as a new "band" between 80 and 40 meters—the RIT (receive incremental tuning) works, so you could follow a drifting distress call, but you can't change the dial frequency to transmit elsewhere. Kudos to Yaesu for thinking of the KL7 hams and their special emergency communications needs up in the auroral zone.

cuit that causes weak signals to go undetected until they build to about 5 microvolts of sensitivity, and then chatter the squelch, the "smooth squelch" on the 847 allows extremely weak signals to glide in and out of the audio circuit. When the squelch opens, it stays open for about a second, and then silently clamps.

While this may not seem like a big deal, it *is* for those of us who aim our antennas at a distant beacon and wait for the tropo to come in. Every now and then, you may hear the squelch open and pass a second or two of signal (or of passing automobile sparkplug noise), and then slowly drop back into full squelch. This means that a weak signal can get through when it's just beginning to come in above the noise level.

No Complaints on Transmit

Everyone we talked to from the mountaintop liked our transmitted audio. The radio has a built-in RF clipping-type speech processor, which could give us an additional 6 dB of "talk power," but we didn't use it. We *did* discover a menu item that allows you to adjust the IF passband frequency of the transmitted signal to enhance the frequency characteristics of your voice pattern. Independent upper sideband and lower sideband alignment menus are provided for this purpose. You

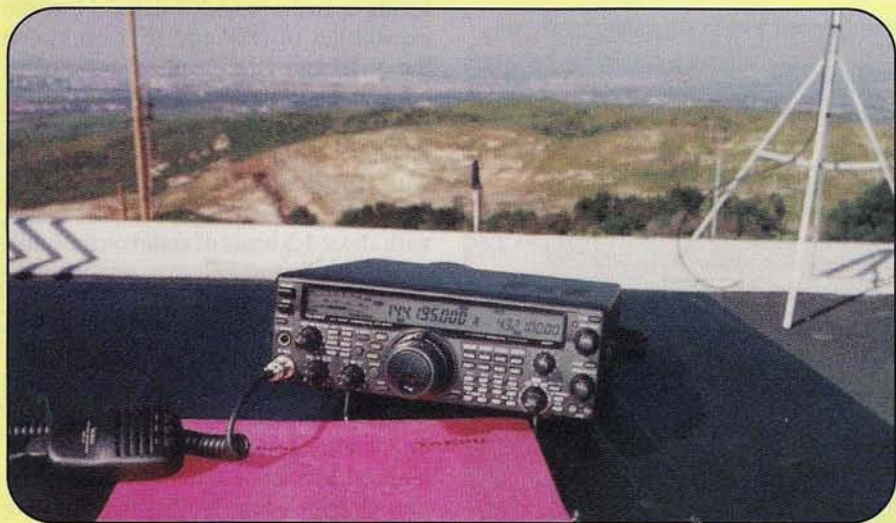


Photo D. From their mountaintop perch, Gordon and Yaesu's Chip Margelli, K7JA, were able to work several hundred miles on 2-meter and 70-centimeter SSB. They tested other bands and modes as well. (WB6NOA photo)

can listen to your own audio changed by the IF transmit passband by pushing in the SSB monitor button.

And for transmitting data, the back of the 847 has just about every interface jack that you'll need. There's even a three-pin data in/out jack that supports push-to-talk control, in addition to AFSK input and output. For 1200/9600-bps VHF/UHF packet, the PKT jack provides optimized input and output data lines, plus PTT and squelch status lines, all set for your terminal node controller (TNC). The data input/output jack RX connection may also be used for 137-MHz weather satellite signals, or for pulling high-frequency weather facsimile signals out of the air and sending them to your computer for decoding. And for scanner listeners prowling the 150-MHz, 500-MHz, or 460-MHz public safety bands, there's also the capability of driving a tape recorder.

Members of the Western States Weak Signal Society were very excited to hear this equipment on the air and had many questions to ask. About the only negative comment came from a ham who raised the question of what happens if something should malfunction on the 2-meter side of things within the unit: "Will the entire rig need to go back to the factory?" The answer appears to be "Yes," because everything was designed as one integral unit. But in my experience of operating the new breed of solid-state equipment, failures for absolutely no reason at all are quite uncommon. Janet Margelli points out that, even if there should be a failure in either the 2-meter, 430 MHz, or 6-

meter side of things, the radio will continue to operate on all of the other bands. She also points out that Yaesu's warranty repair turn-around time is typically two weeks or less.

FM Operating

My next challenge was operating the unit, still without the instruction manual, on the 2-meter and 440-MHz FM bands. There's a 10-key direct frequency entry keypad to allow you to drop in your favorite repeaters. Plus, there are independently programmed repeater shifts for the repeater subbands on 10, 6, and 2 meters and 70 centimeters. The automatic repeater shift built into this rig may help the beginning operator figure out what's plus and what's minus on 2 meters and 440 MHz. Plus, the 847 has a built-in encoder and decoder for both CTCSS and, catch this, DCS (Digital Coded Squelch). And, to make sure you're absolutely on frequency, the S-meter can also double as a center-reading discriminator meter showing frequency excursions of as little as 100 Hz. (Using the discriminator meter can help you develop "signatures" for stations operating on the input of a repeater as you "listen down" to the input with the single push of a button and see exactly *who* they are by *where* they are actually transmitting. Few stations are absolutely dead-on in frequency, and you'd be surprised how easy it is to identify a station by looking at the discriminator meter and seeing whether they are slightly high or slightly low of the center frequency.)

"Operating through repeaters on 2-meter and 70-centimeter FM was a delight—and again, I didn't even need to crack the instruction manual. That was good because...I didn't have one!"

Operating through repeaters on 2-meter and 70-centimeter FM was a delight—and again, I didn't even need to crack the instruction manual. That was good because, as you'll recall, I didn't have one!

Another on-air comment came from Brad Thomas, KC6AUY, with the A.L.E.R.T. Radio Club, who noted that, with its ability to be computer-controlled (see Photo B), the right controller and software should make the 847 into a nice cross-band remote base unit. I wonder who'll be the first to do *this* with the 847?

This 'n That

Let's see now, what are some of the other things we tested when up on the hill? Ten meters was coming in quite well, and, while listening to some South Americans rolling in on 28.500, we could hear a nearby radio operator getting all tuned up with that annoying steady carrier. But a single push of the DSP auto notch filter completely eliminated him—one second, the carrier is blasting your eardrums, and the next second, the carrier gets DSPed away and you're now listening in on the intended signal. I love the capabilities of DSP and all it can do on the VHF and UHF bands. Those of us who also operate HF may already know what it can do down on high frequency, but you've *gotta* listen on VHF and UHF with DSP turned on.

The radio is loud (if you want it to be), with about 1.5 watts of audio on the built-in speaker. But adding an external speaker really lets you go "hi-fi" with the DSP turned on.

In FM, we tuned around the public service bands from 150 to 160 MHz, and from 450 to 470 MHz. Lots of neat stuff up there; and, as long as you're not listening to telephone calls or remote broadcast pickup, you're within the scanning rules. I also tuned just below the 6-meter band, and—my oh my—all the things that you can hear down there from unat-



Photo E. The DSP (digital signal processing) filters improve signals on VHF at least as much as on HF. On 6 meters, DSP adjustments pulled in some 3,000-mile DX! (WB6NOA photo).

tended baby monitors around 46 MHz. But don't tune into cordless phones at 49 MHz; that's taboo.

If you're into flying, the radio automatically goes into AM on the aeronautical frequencies; and if you're into boating, you can easily tune into the 156-MHz marine VHF band. And if the FBI is your thing, you'll find lots of neat stuff around 167 and 420 MHz.

On the Inside

When I looked inside the unit, I couldn't find the built-in antenna tuner. That's because it doesn't have one. No room. That's an outboard option—the FC-20. But the unit is VSWR protected; and, like a good ham, you should resolve high VSWR up at the antenna, rather than masking it by clicking on a built-in tuner. I couldn't find a built-in SWR meter, but you can roughly judge SWR by looking at the power output indicated on the LCD display. If it's putting out its full-rated power (say, 100 watts on 6 meters), then your SWR is flat or nearly so. But if you're only putting out 50 watts, your SWR is above 2:1. If the power output is barely showing as you scream into the microphone, chances are you have the wrong antenna (or no antenna) hooked up to the jack! Best bet—use an outboard SWR meter.

Radio Roast?

I understand that at one recent hamfest, someone accidentally wired up the radio backwards. Better yet, they did it without a fuse (I always say, if you're going to try to roast a radio, why stick a fuse in series?). Reports have it that they smoked the front panel on/off switch, and blew a couple of regulators, and that was it. I'm told that the radio was specifically designed for such a catastrophic event, and had there

been a fuse in place, there would have been no damage. But even without the fuse, the damage was confined to some easily replaceable power supply components. It's good to know design engineers pre-plan when hams may get things backwards and go without fuses.

OK...How Much?

Now for the \$64,000 question: *how much?* No, it won't be \$64,000! The list price for the FT-847 is \$2,399, but the "street price" is very likely to be under \$2,000. Not many options are available for this equipment because almost everything is built in. Sure, you can add a desk-style microphone, or a mobile mic with a keypad on it, or maybe the voice synthesizer unit, or a selection of tighter CW filters. The mobile mounting bracket is extra, but things like the encode/decode board, DCS, digital signal processing, and the VHF/UHF bands are all included.

Oh Yes, HF

Just before we were ready to pull the plug, Janet reminded us to test out the equipment on HF. In our excitement about getting onto VHF and UHF, we almost forgot about the "DC bands." Yes, the FT-847 does a fantastic job on HF, too. But we'll leave it to the HF-oriented magazines to go into detail on HF performance.

For VHF and UHF, sit down in front of one of these rigs at your local ham radio store and listen for yourself. With DSP, it's truly a step up in performance over all of the other rigs you may have listened to before. And for Technician operators, the 6-meter band with 100 watts output is so full of excitement, you could literally work the world as we continue up solar cycle 23.

The Yaesu FT-847—what a rig! ■

Resources

For more information on the FT-847, contact Yaesu USA, 17210 Edwards Rd., Cerritos, CA 90703; Phone: (562) 404-2700; Internet: <<http://www.yaesu.com>>; or your favorite Yaesu dealer.

Additional information on the antennas mentioned in this article is available from the following:

The Maspro 2-meter Yagi is distributed by DNL Antenna Supply, Div. of Power Source Products, 3410 Gibbs Rd., Kansas City, KS 66106. Phone: (913) 677-4766; Internet: <<http://www.wavehunter.com>>

Outbacker Antennas are distributed by Alpha Delta Communications, P.O. Box 620, Manchester, KY 40962; Phone: (606) 598-2029; Fax: (606) 598-4413.

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Packs & Charger for **YAESU FT-50R / 40R / 10R:**

FNB-40xh Slim-NiMH	7.2v	650mAh	\$41.95
FNB-47xh (NiMH)	7.2v	1800mAh	\$49.95
FNB-41xh (5w NiMH)	9.6v	1000mAh	\$49.95
BC-601c	Rapid / Trickle Charger		\$54.95

For **YAESU FT-51R / 41R / 11R:**

FNB-31 pk.	4.8v	700mAh	\$31.95
FNB-38 pk. (5w)	9.6v	700mAh	\$39.95
BC-601b	Rapid / Trickle Charger		\$54.95

For **YAESU FT-530 / 416 / 816 / 76 / 26:**

FNB-26 pk.	7.2v	1200mAh	\$29.95
FNB-27s pk. (5w)	12.0v	800mAh	\$35.95
BC-601a	Rapid / Trickle Charger		\$54.95

For **YAESU FT-411 / 470 / 73 / 33 / 23:**

FNB-10 pk.	7.2v	600mAh	\$20.95
FNB-11 pk. (5w)	12.0v	600mAh	\$24.95
FBA-10	6-Cell AA case		\$14.95
BC-601a	Rapid / Trickle Charger		\$54.95

Packs for **ALINCO DJ-580 / 582 / 180 radios:**

EBP-20ns pk.	7.2v	1500mAh	\$29.95
EBP-22nh pk. (5w)	12.0v	1000mAh	\$36.95
EDH-11	6-Cell AA case		\$14.95

For **ICOM IC-Z1A / T22-42A / W32A / T7A:**

BP-180xh pk. NiMH	7.2v	1000mAh	\$39.95
BP-173 pk. (5w)	9.6v	700mAh	\$49.95
BC-601d	Rapid / Trickle Charger		\$54.95

For **ICOM IC-W21A / 2GXAT / V21AT (Black or Gray)**

BP-131xh (NiMH)	7.2v	1500mAh	\$39.95
BP-132s (5w)	12.0v	850mAh	\$39.95
BC-601e	Rapid / Trickle Charger		\$54.95

For **ICOM IC-2SAT / W2A / 3SAT / 4SAT etc:**

BP-83 pack	7.2v	600mAh	\$23.95
BP-84 pack	7.2v	1200mAh	\$34.95
BP-83xh pk. (NiMH)	7.2v	1500mAh	\$39.95
BP-90	6-Cell AA case		\$15.95
BC-79A	Rapid / Trickle Charger		\$52.95

For **ICOM IC-02AT etc & RadioShack HTX-202/404:**

BP-8h pk.	8.4v	1400mAh	\$32.95
BP-202s pk.	7.2v	1400mAh	\$29.95
IC-8	8-Cell AA NiCd / Alkaline Case		\$15.95
BC-350	Rapid Charger		\$52.95

For **KENWOOD TH-79A / 42A / 22A:**

PB-32xh pk. (NiMH)	6.0v	1000mAh	\$29.95
PB-34xh pack, (5w)	9.6v	1000mAh	\$39.95
KSC-14	Dual Rapid / Trickle Charger		\$62.95

For **KENWOOD TH-78 / 48 / 28 / 27:**

PB-13 (original size!)	7.2v	700mAh	\$26.95
PB-13xh pk. (NiMH)	7.2v	1500mAh	\$39.95
BC-15A	Rapid / Trickle Charger		\$54.95

For **KENWOOD TH-77, 75, 55, 46, 45, 26, 25:**

PB-6 pk. (w/chg plug!)	7.2v	600mAh	\$27.95
PB-8sh pk. (5w)	12.0v	1000mAh	\$39.95
KSC-14	Dual Rapid / Trickle Charger		\$62.95

For **STANDARD C-628A / C558A / 528A / 228A:**

CNB-153xh pack	7.2v	1500mAh	\$32.95
CNB-152 pk. (5w)	12.0v	800mAh	\$32.95
CSA-181	Rapid / Trickle Charger		\$54.95

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