The FT-891 is a 100 W 160 – 6 meter SSB, CW, AM, FM, and data-mode transceiver that includes a general coverage receiver with response from 100 kHz to 74 MHz. The previous generation Yaesu compact 100 W transceivers included two distinct models with similar architectures but different form factors. The FT-857D (still available at the time of this writing) was designed especially for mobile operation, while the FT-897D, with its provision for an internal battery pack, was more oriented for portable operation. Of course, either radio could be adapted to either role, and both have also served as compact home stations.

The FT-891 has dimensions that are almost identical to those of the FT-857D (just 0.6 inches shorter), so a comparison is perhaps appropriate. The FT-891 adds:

- IF digital signal processing (DSP) with variable width filters for all modes, in place of the two slots for optional crystal filters in the '857D. The DSP also provides automatic notching, peaking, and noise rejection. A new 3 kHz wide roofing filter in the first IF improves dynamic range on CW, SSB, and data modes.
- A spectrum display (panadapter) that timeshares the receiver with normal audio operation.

A larger, easier to read, multi-line display.

The FT-891 gives up operation on 144 and 432 MHz in SSB, CW, and FM modes.

It may also be appropriate to consider the FT-891 in comparison to its sibling, the FT-991A.¹ The '991A is a larger, more expensive (about $700 for the '891 versus $1,400 for the '991A), and more capable portable transceiver — perhaps functionally a closer relative to the now-discontinued FT-897D model. If you look at just the '891’s HF capabilities — without looking at the control panel size and capabilities — the '891 is similar to its larger brother. However, it gives up VHF and UHF capability, digital voice, the color display, and the additional controls associated with the larger panel. While the dynamic performance isn’t quite up to that of the FT-991 in most respects, it does track fairly closely.

Controls and Indicators

The compact and easily removable front panel includes a 1¼-inch diameter main tuning knob on the right that tunes with a smooth, weighted feel. Drag is adjustable, which is a great feature for a mobile rig because hitting a bump with your hand near the dial invariably results in changing the VFO frequency. Alternatively, a quick tap of the POWER button, just above the TUNING knob, locks the frequency until tapped again.

On the left side of the front panel are two smaller knobs. On top is a concentric pair providing AF GAIN and RF GAIN adjustment (becomes a SQUELCH control for FM operation). The lower knob is a single MULTIFUNCTION knob that also has a pushbutton capability. The knob can be used to either move the main (VFO A) frequency in 500 kHz steps to change bands or segments, or with a push of the knob, it


Bottom Line

The Yaesu FT-891 brings improved receiver performance and functionality compared to Yaesu’s previous generation compact transceivers, making it a good candidate for a portable or mobile HF rig.
### Table 1
Yaesu FT-891, serial number 6K020054 v01.03

<table>
<thead>
<tr>
<th>Manufacturer's Specifications</th>
<th>Measured in the ARRL Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency coverage:</strong> Receive, 0.03 – 54 MHz; transmit, 160 – 6 meter amateur bands.</td>
<td>Receive, 0.100 – 74 MHz; transmit, as specified.</td>
</tr>
<tr>
<td><strong>Power requirement:</strong> Receive, 2.0 A; transmit, 23 A at 13.8 V dc ±15%.</td>
<td>At 13.8 V dc: Transmit, 18 A (typical), 19 A (maximum). Receive, 1.03 A (max volume, no signal, max backlights); 997 mA (backlights off); 1.01 A (standby, FM only). Power off, 19 mA.</td>
</tr>
<tr>
<td><strong>Modes of operation:</strong> SSB, CW, AM, FM.</td>
<td>As specified.</td>
</tr>
</tbody>
</table>

#### Receiver

**Receiver Dynamic Testing**

<table>
<thead>
<tr>
<th><strong>SSB/CW sensitivity:</strong> (S/N 10 dB), 0.16 µV (1.8 – 30 MHz), 0.16 µV (50 – 54 MHz).</th>
<th>Noise floor (MDS), 500 Hz BW:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preamp off</strong></td>
<td><strong>Preamp on</strong></td>
</tr>
<tr>
<td>0.137 MHz</td>
<td>0 dBm</td>
</tr>
<tr>
<td>0.475 MHz</td>
<td>–111 dBm</td>
</tr>
<tr>
<td>1.0 MHz</td>
<td>–113 dBm</td>
</tr>
<tr>
<td>3.5 MHz</td>
<td>–129 dBm</td>
</tr>
<tr>
<td>14 MHz</td>
<td>–129 dBm</td>
</tr>
<tr>
<td>50 MHz</td>
<td>–129 dBm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>AM sensitivity:</strong> (S/N 10 dB), 5 µV (0.5 – 1.8 MHz); 1.6 µV (1.8 – 30 MHz); 0.16 µV (50 – 54 MHz).</th>
<th>For 12 dB SINAD, 16 kHz BW:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preamp off</strong></td>
<td><strong>Preamp on</strong></td>
</tr>
<tr>
<td>1.0 MHz</td>
<td>19.7 µV</td>
</tr>
<tr>
<td>3.8 MHz</td>
<td>3.75 µV</td>
</tr>
<tr>
<td>29.0 MHz</td>
<td>3.31 µV</td>
</tr>
<tr>
<td>50.4 MHz</td>
<td>3.20 µV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FM sensitivity:</strong> (12 dB SINAD), 0.35 µV (29 MHz and 50 – 54 MHz).</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preamp off</strong></td>
<td><strong>Preamp on</strong></td>
</tr>
<tr>
<td>29 MHz</td>
<td>0.72 µV</td>
</tr>
<tr>
<td>52 MHz</td>
<td>0.82 µV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Blocking gain compression dynamic range:</strong></th>
<th>Blocking gain compression dynamic range, 500 Hz BW:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preamp off/on</strong></td>
<td><strong>Preamp off</strong></td>
</tr>
<tr>
<td>20 kHz offset</td>
<td>115/115 dB</td>
</tr>
<tr>
<td>5/2 kHz offset</td>
<td>107/87 dB</td>
</tr>
</tbody>
</table>

#### ARRLL Lab Two-Tone IMD Dynamic Range Testing (500 Hz bandwidth)

<table>
<thead>
<tr>
<th><strong>Band/preamp</strong></th>
<th><strong>Spacing</strong></th>
<th><strong>IMD Level Input Level</strong></th>
<th><strong>IMD DR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 MHz/off</td>
<td>20 kHz</td>
<td>–129 dBm</td>
<td>–97 dBm</td>
</tr>
<tr>
<td>14 MHz/off</td>
<td>20 kHz</td>
<td>–129 dBm</td>
<td>–97 dBm</td>
</tr>
<tr>
<td>14 MHz/off</td>
<td>5 kHz</td>
<td>–129 dBm</td>
<td>–97 dBm</td>
</tr>
<tr>
<td>14 MHz/off</td>
<td>2 kHz</td>
<td>–129 dBm</td>
<td>–97 dBm</td>
</tr>
</tbody>
</table>
Manufacturer’s Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured in the ARRL Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second-order intercept point: Not specified.</td>
<td>Preamp off/on: 14 MHz, +79/+73 dBm; 21 MHz, +77/+69 dBm; 50 MHz, +91/+73 dBm.</td>
</tr>
<tr>
<td>FM adjacent channel rejection: Not specified.</td>
<td>Preamp on, 29 MHz, 66 dB; 52 MHz, 65 dB.</td>
</tr>
<tr>
<td>FM intermodulation distortion dynamic range: Not specified.</td>
<td>Preamp on, 20 kHz spacing: 29 MHz, 66 dB*; 52 MHz, 65 dB*; 10 MHz spacing: 29 MHz, 129 dB, 52 MHz, 114 dB.</td>
</tr>
<tr>
<td>DSP noise reduction: Not specified.</td>
<td>10 dB, maximum.</td>
</tr>
<tr>
<td>Notch filter depth: Not specified.</td>
<td>&gt;60 dB (tunable notch filter).</td>
</tr>
<tr>
<td>S-meter sensitivity: Not specified.</td>
<td>S-9 signal, preamp off/on 14 MHz, 138/32.3 µV; 50 MHz, 78.5/66.6 µV.</td>
</tr>
<tr>
<td>Receive processing delay time: Not specified.</td>
<td>At speaker, 12 ms.</td>
</tr>
<tr>
<td>IF/audio response: Not specified.</td>
<td>Range at –6 dB points (bandwidth):** CW (500 Hz): 345 – 860 Hz (515 Hz); Equivalent Rectangular BW: 509 Hz; USB (2.4 kHz): 272 – 2,680 Hz (2,408 Hz); LSB (2.4 kHz): 281 – 2,680 Hz (2,399 Hz); AM (6 kHz): 225 – 2,725 Hz (5,000 Hz).</td>
</tr>
<tr>
<td>IF rejection: Not specified.</td>
<td>14 MHz, 129 dB; 50 MHz, 96 dB.</td>
</tr>
<tr>
<td>Image rejection: Not specified.</td>
<td>14 MHz, 123 dB; 50 MHz, 123 dB.</td>
</tr>
</tbody>
</table>

Transmitter

| Power output: 100 W (40 W AM). | 5 – 100 W (CW, SSB, FM); 5 – 40 W (AM). RF power output at minimum specified voltage: 76 W (HF), 73 W (50 MHz). |
| Spurious-signal and harmonic suppression: | >50 dB (HF); >63 dB (50 MHz). |
| SSB carrier suppression: Not specified. | >70 dB. |
| Third-order intermodulation distortion (IMD): | Not specified. |
| Transmit bandwidth: Not specified. | Range at –6 dB points, 200 – 2,800 Hz (default). |
| CW keyer speed range: Not specified. | 4 to 59 WPM, iambic modes A and B. |
| CW keying characteristics: Not specified. | See Figures 1 and 2. |
| Transmit-receive turn-around time: Not specified. | S-9 signal, AGC fast: SSB, 37 ms; CW, 30 ms. |
| Size: 2.2 × 6.4 × 10 inches. Weight, 4.7 lb. | See Figure 3. |
| Price: FT-891, $699; FH-2 keypad control, $91; FC-40 wire antenna tuner, $275; FC-50 coax antenna tuner, $324; YSK-891 separation kit, $74. |
| Second-order intercept points were determined using S-5 reference. |

*Measurement was noise limited at the value indicated.

**Default values; bandwidth is adjustable via DSP settings.
will toggle to adjust the VFO B or secondary frequency at normal rates. This knob and button are also major players in the selection of functions and menu items, to be discussed later.

On the top of the front panel is a row of eight illuminated buttons that provide memory storage and retrieval, VFO A/B selection, BAND selection (a long press provides MODE selection), a FAST key for quicker tuning (but not as quick as the 500 kHz steps of the MULTIFUNCTION knob), and a POWER on/off and LOCK button. The FAST button is very handy for band segment changes. In SSB mode, for example, the very comfortable SSB tuning default rate of 2 kHz per turn (menu settable) jumps to 20 kHz per knob revolution in FAST mode — great for a quick look over the band, or to change segments.

The bottom of the front panel contains five more buttons. The left-hand F button is used to enter the FUNCTION mode. Repeated pressing of the button cycles through four screens with a total of about 28 function choices. One of the four screens is CW specific, while the others are general. In addition, using the menu, special screens for FM (five functions), recording and playback (eight functions), and ATAS antenna control (RAISE and LOWER buttons) can be included in the function selection process.

The FT-891 provides a lot of capability and many configuration and operational choices. A natural consequence is that many adjustments need to be made via menu and function key selection. A long press of the F key moves you into MENU mode, allowing the choice of no less than 184 menu items in 18 groups. Most, but not all, are set-and-forget items. There are so many because of the flexibility offered. Fortunately, they are all in plain English, although some abbreviations will take a look-up the first time.

The bottom right-hand CLAR button serves as receive-incremental tuning (RIT) by default, but it can be changed by a menu item to offset the transmit or transceive frequencies, if desired.

The three middle buttons are labeled A, B, and C. These come configured by default as IF SHIFT (SFT), SPECTRUM DISPLAY INITIATE (SCP), and NOISE BLANKER (NB). By a press of one of the buttons while in FUNCTION mode, the selected function will be set into place with whatever key is pressed. Fortunately, the function labels (as in the default items in parentheses above) appear above the key on the LCD display after assignment. This is a very useful capability. I gave up the SCP function in favor of the NAR function that selects the narrower receive bandwidth for each mode.

Behind the front panel is a SPEAKER/PHONES switch. This sets the level of the combined rear panel SPEAKER/PHONES jack (labeled SPKR) to avoid injury due to high audio levels while plugging in headphones. While we’re here, the MIC connector is also behind the front panel on the main unit. The optional YSK-891 separation kit provides the cables and hardware to allow the front panel to be mounted separately from the main equipment chassis. This is particularly handy for mobile installations to allow the front panel to be dash mounted with the main radio body installed under the seat or in the trunk.

There are 99 regular memories, as well as nine pairs of scan range memories, and 10 memories preset for the five US 60-meter channels (five each for CW and SSB). To access the memories, you have to first push the V/M button to enter memory mode. Then you will be able to roll through the memories with the MULTIFUNCTION knob, and be able to transmit on the channels. There are also five one-push “quick memories,” accessed by the dedicated QMB button.

Connections and Connectors
The rear panel has all the connectors, except for the eight-pin RJ-45 type MIC connector behind the front panel. The rear panel offers a GROUND terminal, a FIRMWARE UPDATE switch, an eight-pin DIN-type TUN/LIN connector for connecting a Yaesu or compatible antenna tuner, such as the FC-40 or 50, or a VL-1000 amplifier, and a USB jack for interconnection to a PC. The antenna connects to an SO-239 socket.

There are three 3.5-millimeter phone jacks. The first is a REM/ALC stereo jack for either the optional FH-2 keypad or ALC input from a linear amplifier. The next is another stereo jack, this one for CW keying. It can be menu set to use a hand key (or external keyer) or paddles for the internal electronic key. And finally a mono jack for speaker or phones, as set by the switch behind the front panel.

Scope Function
The FT-891 offers a spectrum scope function. The scope time-shares the single receiver, and while on, the soft A, B, and C buttons become scope specific. The display is centered on the receive frequency, and the span can be set to ±17.5, 35, 70, 175, or ±350 kHz using the SPN button.

I found that the scope could be used in a number of ways. In the default mode, it makes a single sweep each time the soft SWEEP (SWP) button is pressed — handy to check nearby signals during a lull in the conversation. A third soft button (LV1-LV3) gives three level options to compensate for different signal or noise levels and set the amplitude range of the display. You can change the transceive frequency while in this mode, and the center cursor will move as you tune. The next time you hit SWP, the display will re-center, so you can easily tune to a displayed signal. The top of the display shows the receive frequency as you tune.

The scope can be set to run continuously, with the receiver muted, by a longer push of the SWP button. This can be handy if you like to monitor a
Computer Functionality

The FT-891 supports PC connection options via a USB port. The Yaesu software download website includes a virtual COM port driver needed to use the USB connection. Instructions for installation of the drivers are in a separate manual, also available from the website. The manuals don’t provide a lot of information about operating the FT-891 with a computer, except to note that unlike other radios in its family, it doesn’t support audio interfacing with an internal sound-card function via the USB connection. A few interface (CAT) menu settings, such as data rate, are provided.

During Lab testing, we were able to successfully download a new firmware version. While an update to the N1MM+ logging software (version 1.0.6033) that was released during the evaluation listed the FT-891 as a supported radio, it did not communicate at W1ZR for some reason. For those who want to modify or develop their own CAT software, another manual on their website, FT-891 CAT Operation Reference Book, provides the details of the command language. A separate DIN RTTY/DATA jack on the rear panel provides connectivity for digital modes.

On the Air at W1ZR

SSB Operation

I used the FT-891 to check into a local radio club net on 75-meter SSB, and then we moved to 40 meters. Reports were better after we moved to 40 meters, which had less noise and better propagation. The supplied microphone has a TONE switch on the rear that can select a FLAT (1) or EMPHASIZED (2) audio response. The consensus was that, for my voice, 1 was a better choice, with 2 sounding too bassy. I found the three-range transmit equalizer more effective in making me sound better on the air. It can be easily adjusted while listening to your audio with the MONITOR on, while using headphontes to avoid feedback. The group agreed that using the parametric equalizer made a big difference.

I found that the VOX (voice-operated transmit switching) function worked quite smoothly. This is turned on via a function, with the gain, delay, and anti-vox set from a menu. The transmit gain and compression levels are also set using menu items. The Lab noticed that, as with many radios, if the gain or compression is set to drive the transmitter too hard, the distortion goes up quickly. I received solid reports by keeping the gain and compression levels such that the ALC meter stayed near the middle of the range and the peak power just touched a peak of 100 W on occasions.

Other Voice Modes

The FT-891 supports both AM and FM voice operation in addition to SSB. On AM, the transceiver can put out a carrier level of up to 40 W. AM operation seemed straightforward with good audio on both transmit and receive. FM operation is well supported, including a special function screen that allows setup of repeater offsets, CTCSS tones and DCS (digitally coded squelch) codes. For the first time, I actually was able to make a contact with someone using a 10-meter FM repeater — N2ACF/R located across the Hudson in Rockland County, New York. It seemed to work fine with good reports in both directions — thanks to Ray, K2NET, for being there.

It was easy to set the frequency, offset, and tones into memory. I found that repeaters with different offsets on the same band could not be stored in different memory channels — the last offset entered would apply to all memo-

Lab Notes: Yaesu FT-891 HF/6-Meter Mobile Transceiver

Bob Allison, WB1GCM, ARRL Laboratory Assistant Manager

The Yaesu FT-891 is most suitable for mobile, portable, and home station work, using simple antenna systems with low gain. In other words, it’s not a high-performing contest transceiver. Its lowest receive dynamic range at 2 kHz spacing is 68 dB (third-order IMD DR). On the transmit side, the transmit phase is about the highest we’ve yet seen at the Lab. For this reason alone, I would be wary of pairing this transceiver with an RF amplifier. Users of the FT-891 must watch the ALC level when transmitting voice, because transmit IMD levels tend to get high if the ALC indicator reaches the top end of the scale. Keep it halfway or lower for SSB operation. The indicated ALC level should be minimal when using digital modes, the same as with all other transceivers. The transmitter does have excellent harmonic and spurious suppression, typically at or greater than 66 dB on the HF bands. This is always helpful during Field Day, or appreciated by your neighborhood radio amateur.

One other notable test result: When operating at the minimum specified voltage (11.7 V), the RF power output drops 25%. Though this power reduction will not make a big difference at the receiving end, it is something to keep in mind during battery-powered portable operation. I listened carefully using a test receiver and heard no audio distortion or frequency shifts while operating at the minimum specified voltage. One operating observation: Filter bandwidth settings are not saved when switching bands. If 500 Hz CW bandwidth is assigned to a band and then the band is changed, then back to the original band, the CW bandwidth reverts to 2,400 Hz.

Overall, this is an easy radio to operate with its flexible menu. The frequency display is larger than most transceivers of its size — a good feature for mobile operation. The FT-891 hears well on 6 meters, too — a band where a low noise floor is helpful.
rized channels on that band. I had to set
the offset per band to the standard
value (the memory would store a plus
or minus offset) and then use the split
frequency (SPL) function to set up a
repeater with an unusual offset.

**CW Operation**
The FT-891 was a joy to operate on
CW. The built-in electronic keyer
worked very well, offering speed selec-
tion by function selection from an indi-
cated 4 to 60 words per minute. The
key input can be function selected for
use with a straight key (or external
keyer) or paddles. The paddles can be
operated in multiple keyer modes, or be
used as a semi-auto (bug) emulation.

I usually operate in full break-in (QSK)
mode, to allow hearing interfering sig-
als while I transmit, and the break-in
was smooth with just a mildly audible
relay sound — well below the monitor
level that I used. The relays were not
audible to me at all while using head-
phones. Semi-break-in is also provided
with a “hang” delay menu adjustable
from 30 ms to 3 s. The lower values
acted about like full break-in at my
keying speeds. The dot/dash weight and
waveform rise time are also menu set-
table between 2 and 4 ms. The spec-
trum test data was taken with the 4 ms
setting, and I would not suggest going
for a quicker rise time. A slower rise
time would likely improve the band-
width of the transmitted keying
sidebands.

The CW keyer includes five memories,
each of up to 50 characters, that can be
used in regular or contest mode, with
automatically sequenced numbers. The
memories can be stored or accessed
either through function keys or by
using the optional FH-2 keypad. The
keypad offers the advantage that the
main display, including frequency and
functional indicators, can be observed
while keying.

I found the rig to be a good performer
on CW. My first CW contact happened
as I was listening around and heard an
old friend, Tony Berg, W1OT, now in
Williamsburg, Virginia. I worked with
Tony during my first (1969) engineer-
ing job in Massachusetts, while Tony
managed an HF receiver systems engi-
neering group. He knows his stuff, and
he thought my signal sounded as good
as with my usual radio.

For my operating preferences on CW, I
adjusted the wide bandwidth from its
default of 2,400 to 1,200 Hz, set the
narrow (NAR) function into button B
(instead of the default spectrum dis-
play), and set the narrow bandwidth to
250 Hz. These bandwidth settings can
be made separately for each mode.

**Antenna Tuner Options**
The FT-891 does not include a built-in
antenna tuner. This won’t be a problem
for operators who have resonant anten-
as. In my experience, many antennas
(including most HF mobile antennas)
have limited bandwidth, and a tuner can
be a real plus. The FT-891 does have a
jack designed for connection to one of
Yaesu’s two available auto tuners,
either the FC-40 wire antenna tuner, or
the FC-50 coax antenna tuner. The jack
can also be menu configured to inter-
face with a linear amplifier, or raise and
lower their ATAS mobile antenna.

I am sure that the ’891 will work seam-
lessly with one of their auto tuners, or
perhaps with a compatible aftermarket
unit. Unfortunately, I had a manual-
tuned tuner at hand. In order to tune to
a new frequency, I had to go to a menu
to set the power output to 10 W, then
use a function key to change the meter
to standing-wave ratio (SWR), change
the key to straight key, key the trans-
mitter, and adjust the tuner for mini-
imum SWR. Then remember to go back
and reset everything and hope the sta-
tion I was going to call was still there. I
propose that Yaesu consider another
option in their TUNER SELECT menu —
how about a choice of EXTERNAL?
Then, with a single push of the TUN
function, all of those actions could
occur, with normal operation returning
with another push. Fortunately, during
the testing, W1ZR added a high-power
auto tuner that could tune while 100 W
was applied — problem solved —
although perhaps not the least expen-
sive solution!

**Documentation**
Our FT-891 came with a 58-page
Operating Manual that includes a refer-
ence to an FT-891 Advance Manual,
available for download on their web-
site. You might think that the Advance
Manual is something to look at only if
you are interested in doing some
advanced functionality, but it is much
more.

While the Operating Manual includes a
description of every control, along with
a short description of the choices, it
takes the 113-page Advance Manual to
find details of what each of the choices
means, along with step-by-step instruc-
tions for each function, including links
to the applicable menu choices.

With a total of 184 menu items in 18
groups, 28 standard functions on three
pages, plus extra pages that can be
enabled for CW and FM function
choices — you really need to look at
both volumes to know how to use this
radio to its full capability. Once I
downloaded the Advance Manual, I
found the pair of manuals complete,
well written, and easy to follow.

Manufacturer: Yaesu USA, 6125
Phyllis Dr., Cypress, CA 90630; Tel.
714-827-7600; [www.yaesu.com](http://www.yaesu.com).

to see our review of the Yaesu
FT-891 HF and 6-meter transceiver
on YouTube.