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ICOM IC-737 MF/HF Transceiver

Lowe HF-150 LF/MF/HF Communications Receiver

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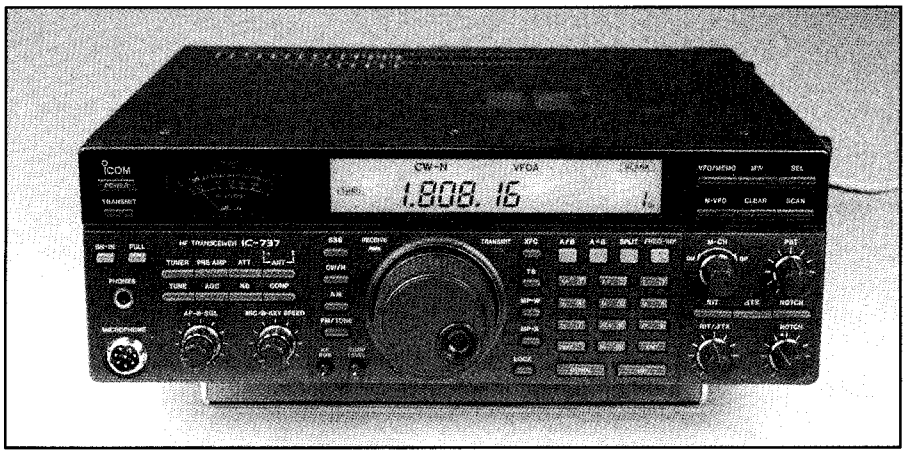
ICOM IC-737 MF/HF Transceiver

Reviewed by James W. "Rus" Healy, NJ2L

With the exception of last year's IC-728 and 729, it's been several years since ICOM released a major MF/HF transceiver. The IC-737 marks the beginning of a new era for ICOM, as the replacement for their popular and unusually enduring IC-751A. What the IC-751A lacks in '90s features, it makes up for in good basic performance, small size and low cost. ICOM maintains the same basic emphasis in the IC-737, but also includes features new to MF/HF transceivers in any price class.



Standard Features and Options

The IC-737 comes with a good collection of features useful to a wide spectrum of MF/HF operators. Aside from the usual AM, CW, FM and SSB operation, memories (101 in this case) and scanning options, it features semi- and full-break-in CW operation, automatic antenna tuner, RF preamplifier, audio speech processor, internal electronic keyer, computer-control capability, user-configurable software options, dual band-stacking registers, direct frequency entry, single-button band selection, and an attractive package. Its main display is a large, uniformly backlit liquid-crystal unit that shows the frequencies of both VFOs (when in split mode), with the current VFO frequency in large digits. Several annunciators around the display perimeter show selected memory channel, mode, and status indicators for the antenna tuner, noise blanker, split-frequency mode, selected VFO and a few other things.

The rig lacks some features that are standard on its competitors. Most notably, it has no SSB VOX circuit. Its metering functions are limited to received signal strength and relative transmitter power output. It doesn't display SWR, or transmitter ALC and processor levels. (In place of ALC metering, the rig's front-panel **TRANSMIT** LED intensifies on voice peaks during SSB transmission when the mike gain is properly adjusted, as with the IC-728.)

Features unique to the IC-737 include a nifty two-antenna switching option. You can connect two antennas to the radio and switch between them manually or key them to particular bands for automatic selection. For instance, if you use a multiband Yagi for 20 through 10 meters and wire antennas fed via an external switch for the other bands, you can easily configure the rig (via a software switch) to switch to the appropriate output when you go to each band. Changing your selection is simple: Poke the **ANT 1/2** button. An LED shows you which antenna you're using. If you don't use two antennas, you can tell the rig to ignore pushes of that button so that you don't accidentally transmit into an open connector.

ICOM includes a feature it calls *dual band-stacking registers* in the IC-737. Each band button now includes two sets of data—VFOs, in effect—with separate information. Pressing a band button repeatedly toggles between the two sets of data. (This feature is similar to Yaesu's implementation in the FT-1000 and FT-990.)

The IC-737's VFOs store frequency and mode. They do not store tuner, preamplifier, AGC, noise-blanker, RIT/ΔTX and compressor settings, or antenna selection (except when antenna selection is keyed to a band, as discussed later). VFO storage of these functions would be a welcome addition to the radio's software. Similarly, the RIT offset cannot be cleared in software. You must turn the RIT off or center the knob to eliminate the offset.

Like most modern transceivers, the IC-737 uses menu-driven software that lets you configure options such as tuning-step size, antenna-jack selection (off, manual or automatic by band), RIT and ΔTX range (1.25 or 2.5 kHz), scan-resume and -speed options, and computer-control information (data rate, radio address, etc). You access the menu by turning off the radio, then holding two buttons while turning it back on. You must once again turn the radio off to leave the menu mode.

Another menu selection is the number of memories available in the *Memo Pad*. This feature, like Kenwood's Quick Memo in the TS-850S and TS-950SDX, Ten-Tec's Scratch Pad memory in the Omni VI and a similar feature in the IC-781, lets you store either 5 or 10 sets of VFO data for quick recall using the **MP-W** (write) and **MP-R** (read) keys. Particularly useful during contests, the Memo Pad lets you quickly return to pile-up frequencies as you tune the bands.

The Bottom Line

A more than worthy successor to the IC-751A, the IC-737 makes high marks in basic radio performance and includes all the ingredients of a transceiver you can grow with—and at a very reasonable price.

Like many modern radios, the IC-737 comes with an automatic antenna tuner. Also like other radios that include this feature, the tuner is in-line *only* during transmitting. It's a fast, quiet, wide-range matching network with memories that allow it to quickly return to previous settings when you change bands. Unlike other automatic tuners I've tested, the IC-737's tuner matches my 210-foot-long inverted **L** on every ham band from 1.8 through 29 MHz. (Most tuners refuse to match it on at least one band.) Only at the low end of 15 meters is it unable to match this particular antenna.

The IC-737 is shipped with an HM-36 hand microphone, a 13.8-V dc power cord, a spare fuse and a three-conductor plug for the key/keyer jack. Options include four CW filters: 250- and 500-Hz versions for the radio's 9-MHz and 455-kHz IFs. (No SSB or AM IF-filtering options are offered.) Also available are power supplies, desk mikes, external speakers, a mobile mounting bracket, external nine-antenna selector (driven by the radio's band-data jack), subaudible tone encoder for 29-MHz FM operation, and a high-stability reference-crystal unit.

Installing the CW filters is a simple matter of removing the radio's bottom cover, plugging in the filters and flipping a corresponding DIP switch for each installed filter. The process takes less than 10 minutes.

Receiver Performance

For a transceiver in this price class, the IC-737 features generally outstanding receiver performance. Its preamplifier is robust and usefully improves sensitivity on

Table 1
ICOM IC-737 160-10 Meter Transceiver, Serial Number 01266

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 0.5-30 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, 24.89-99, and 28-29.7 MHz.	As specified.
Modes of operation: AM, CW, FM, LSB, USB.	As specified.
Power requirement: 13.8 V dc ±15%, 20 A max (TX), 2.1 A max (RX).	At 13.8 V, 13.5 A max (TX), 1.45 A max (RX).
Receiver	*Receiver Dynamic Testing*
SSB/CW receiver sensitivity (preamp on, bandwidthnot specified, 10 dB S+N/N): 0.16 μV (–123 dBm).	Minimum discernible signal with 500-Hz IF filters:

	Preamp Off	*Preamp On*
1.0 MHz	–122 dBm	N/A
3.5 MHz	–130 dBm	–139 dBm
14.0 MHz	–130 dBm	–137 dBm
28.0 MHz	–129 dBm	–137 dBm

AM (10 dB S/N): 0.5-1.8 MHz, 13 μV (–85 dBm); 1.8-30 MHz, 2 μV (–101 dBm).	10 dB S+N/N (signal 30% modulated with a 1-kHz tone, preamp on): 1 MHz, –97 dBm; 3.8 MHz, –113 dBm.
FM, 12 dB SINAD: 28-29.7 MHz, 0.5 μV (–113 dBm).	12 dB SINAD, preamp on: –121 dBm.
Blocking dynamic range: Not specified.	Blocking dynamic range (500-Hz IF filters):*

	Preamp Off	*Preamp On*
1.0 MHz	132 dB	N/A
3.5 MHz	122 dB	118 dB
14.0 MHz	122 dB	118 dB
28.0 MHz	123 dB	117 dB

Two-tone, third-order intermodulation distortion dynamic range: Not specified.	Two-tone IMD dynamic range (500-Hz IF filters):*

	Preamp Off	*Preamp On*
1.0 MHz	92 dB	N/A
3.5 MHz	96 dB	94 dB
14.0 MHz	98 dB	95 dB
28.0 MHz	95 dB	94 dB

	Preamp Off	*Preamp On*
Third-order input intercept: Not specified.		
1.0 MHz	16 dBm	N/A
3.5 MHz	14 dBm	2 dBm
14.0 MHz	17 dBm	5.5 dBm
28.0 MHz	13.5 dBm	4 dBm

S-meter sensitivity: Not specified.	For S9 reading at 14 MHz: preamp off, 193 μV; preamp on, 57.5 μV.
CW/SSB squelch sensitivity: Less than 5.6 μV.	As specified.
FM squelch sensitivity: Less than 0.3 μV.	As specified.
Notch filter attenuation: Not specified.	1.9-kHz tone, 35 dB; 700-Hz tone, >50 dB.
Receiver audio output: More than 2.6 W at 10% THD into 8 Ω.	2.65 W at 10% THD into 8 Ω.
Receiver IF/audio response: Not specified.	At –6 dB, **PBT** centered: SSB, 428-2611 Hz (2183 Hz); CW-N, 538-1031 Hz (493 Hz); AM, 230-2700 Hz (2677 Hz).
Transmitter	*Transmitter Dynamic Testing*
Transmitter power output: CW, FM, SSB, 100 W; AM, 40 W max.	CW, FM, SSB: output continuously variable from 7 to 110 W, typ, varies slightly from band to band; AM, variable from 8 to 40 W, typ, varies slightly from band to band.
Spurious-signal and harmonic suppression: 50 dB	As specified. The IC-737 meets FCC spectral-purity specifications for equipment in its power-output class and frequency range.
Third-order intermodulation distortion products: Not specified.	See Fig 1.
CW-keying characteristics: Not specified.	See Fig 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S1 signal, 40 ms; S9 signal, 19 ms.
Composite transmitted noise: Not specified.	See Fig 3.

Size (height, width, depth): 4.4 × 13 × 11.2 inches; weight, 17.7 lb.

*Dynamic-range measurements were made at the ARRL Lab standard signal spacing of 20 kHz.

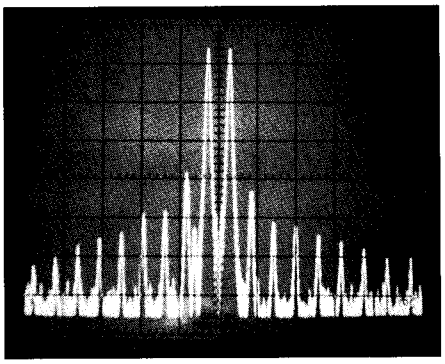
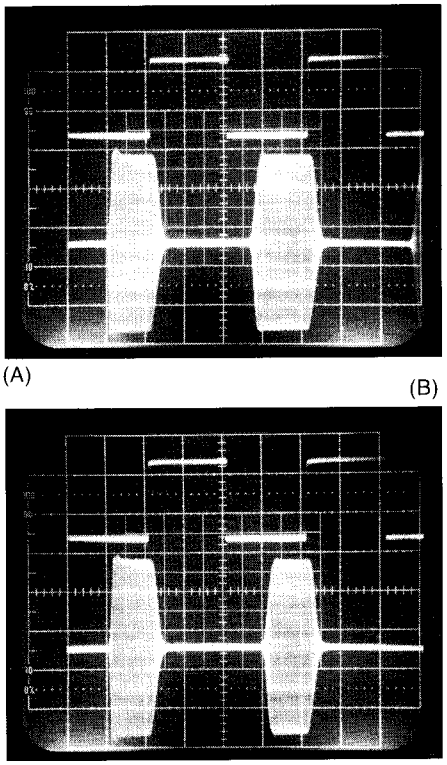


Fig 1—Spectral display of the IC-737 transmitter during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 39 dB below PEP output, and fifth-order products are approximately 48 dB down. Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The transceiver was being operated at 100 W PEP output at 3.9 MHz.



(A) (B)

Fig 2—CW-keying waveforms for the ICOM IC-737 in the semi-break-in mode (A) and the full-QSK mode (B). The upper traces are the actual key closures; the lower traces are the RF envelopes. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14 MHz.

the high-frequency bands, yet barely impacts the receiver's blocking and two-tone, third-order IMD dynamic range. The receiver AGC characteristics are excellent. Overshoot is minimal—even on meter-pinning signals—and strong SSB signals sound good with fast AGC. A front-panel button selects a fast or slow AGC time constant; the AGC can't be disabled.

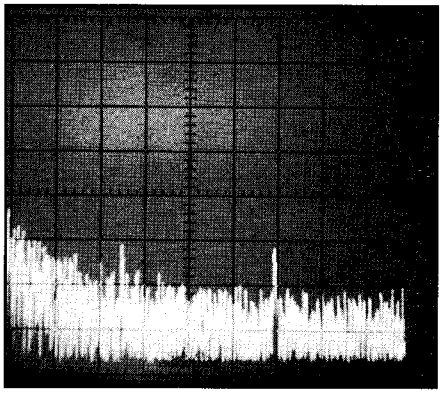


Fig 3—Spectral display of the IC-737 transmitter output during composite-noise testing. Power output is 100 W at 14 MHz. Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The log reference level (the top horizontal line on the scale) represents –60 dBc/Hz and the baseline is –140 dBc/Hz. The carrier, off the left edge of the photograph, is not shown. This photograph shows composite transmitted noise 2 to 20 kHz from the carrier.

Tuning the radio and working its knobs and buttons gives a solid, smooth and high-quality feel. The main tuning knob has a front-panel adjustable brake that lets you easily set the knob for anything between free-spinning and tight. Tuning speed increases when you spin the knob quickly. The default tuning rate, 2 kHz per knob revolution (in SSB and CW), is appropriate.

All the front panel's controls and buttons are well-spaced and prominent, and the panel layout is clutter-free. The band/frequency labels are somewhat hard to read (light blue labels on light gray buttons), but otherwise the controls are excellent. The front panel lacks one feature I'd like: a CW key/keyer paddle jack. This and two other controls, CW break-in delay and the keyer on/off button, are also on the back panel. Unfriendlier yet, the delay control is a recessed, Phillips-head potentiometer.

Receiver audio is plentiful and fairly clear, though it suffers from rolloff in the IF and/or audio chains, removing some fidelity from SSB and AM signals. Even with its 6-kHz AM filter, AM audio sounds somewhat mushy because it rolls off to 6 dB at about 2.7 kHz (see Table 1). If you're an SWL, you may not find this rig's audio performance between the ham bands as pleasant as you'd like. Just the same, the receiver produces good communications-quality audio on all modes. In addition to the high-end rolloff, the audio amplifier is quite noisy. It produces considerable hiss that's audible at normal listening levels on quiet bands. Feeding the rig's rear-panel, fixed-level audio output into an external amplifier yields cleaner audio than that available from the rig's headphone/speaker outputs. In this era of inexpensive portable stereos with incredibly low noise and distortion, ICOM should be able to do better.

The IC-737 uses a tunable audio notch filter.[1] This filter tunes smoothly and helpfully attenuates unwanted carriers, but its depth varies slightly with the audio frequency to which it's tuned (see Table 1). Because the notch is outside the AGC loop, it can reduce or eliminate strong signals from the receiver *audio*, but it doesn't keep those signals from actuating the AGC—the general problem with any audio filter.

The ICOM PBT (passband tuning) circuit is similar to what Kenwood calls VBT—variable-bandwidth tuning—in that it lets you change the passband width. It differs from Kenwood VBT in that it narrows the passband from one side or the other, depending on which way you rotate the knob from its center detent, rather than taking a uniform amount from each side of the center frequency. In this sense, it's a cross between IF shift and VBT, and finds routine use on CW and SSB.

CW Operation

In most respects, the IC-737 is a joy to use on CW. Semi- and full-break-in keying are smooth and pleasant from the transmitting end as well as the receiving end; transitions from receive to transmit and back are completely free of audio thumps and clicks. The photos show that the waveshapes of the rig's keyed signals are excellent in both modes, and on-the-air reports confirm this. The only annoyance is a rather noisy relay that clicks in step with the keying. The '737 tunes CW signals as lower sideband, a fairly uncommon choice these days, but isn't difficult to get used to. The rig's internal keyer works well. The keyer-speed knob gives a range of approximately 7 to 50 WPM, and operates linearly across this range.

Many operators prefer the ability to set a rig's CW offset (and sidetone) to a fairly low frequency (under 500 Hz). For those of us in this category, the IC-737's fixed 750-Hz offset and sidetone is frustrating. Especially in the midst of summertime static, the shrillness of relatively high-frequency audio noise in the passband makes weak-signal copy tiring, even with the 500-Hz CW filters in line. Otherwise, however, the CW filters provide steep skirts and good characteristics, including a contribution to the rig's high dynamic range. With its exceptionally quiet frequency-synthesis system, this radio more than holds its own in serious strong-signal environments like CW contests and pile-ups. Since we began composite-noise testing in the ARRL Lab in 1988, this is *the cleanest* rig in that respect that we've reviewed. Hats off to ICOM!

SSB and Other Modes

Though it's not a high-end rig made for super-demanding applications, the IC-737 does a good job in SSB operation. Its low-IMD transmitted audio gets good marks, and its receiver is great for most operating. In contests and DXing, the rig's lack of an optional narrow SSB filter hinders its performance, but the passband-tuning circuit helps eliminate off-frequency signals. Also, the notch filter can give a useful passband-shaping effect when you're not using it as a notch.

In split-frequency operation, the IC-737 is great. It has the direct equivalent of an IC-781 and Kenwood feature I've loved for a long time: a momentary push-button switch (**XFC**) that lets you listen to and set your transmit frequency. With this setup, you don't need to go through the three-step process of switching VFOs, finding the correct frequency, and then switching VFOs again when calling in a split-frequency pile-up. This, coupled with the fact that both VFO frequencies are displayed during split-frequency operation, makes the IC-737 a distinct pleasure to use on any mode in which you use this feature.

For data modes, the IC-737 includes a set of rear-panel connections for a packet-radio TNC, RTTY interface or multimode data controller. Although the rig doesn't support FSK operation, these modes are available as AFSK in SSB or FM. In SSB AFSK operation, the frequency display doesn't indicate the mark or space frequency, but the manual tells you how to calculate it based on the sideband in use.

In a radio in this price class, it's hard to excuse the lack of meter scales for ALC and speech processing. As mentioned earlier, the **TRANSMIT** LED doubles as an ALC indicator, but the instruction manual's sole hint on setting the processor level is a small drawing that tells you to set the knob between 10 and 12 o'clock. Although I've found (by monitoring my signal in another receiver and asking on-the-air contacts) that it's nigh impossible to make this radio sound *bad* or generate a wide signal with the stock microphone, regardless of mike-gain or **COMP LEVEL** settings, I'm constantly uneasy about "hitting it too hard" during SSB operation.

During CW, SSB, and FM operation, the IC-737's power output is continuously variable from about 8 watts to slightly more than 100 W (see Table 1). For QRP operators, the low end isn't quite low enough. There is, however, a good alternative to turning down the power internally or using an outboard attenuator: You can apply 0 to –4 V to the rig's rear-panel **ALC** jack to reduce its output power. This is easy to do with a 9-V battery and a 5-kΩ potentiometer (wiper to **ALC** connector center pin, one end to ground, one end to negative battery lead, positive battery lead to radio ground). Install a 6.2-kΩ resistor in series with the potentiometer to avoid exceeding the rig's ALC-voltage range. With this setup, you can smoothly adjust the rig's RF output to less than 50 mW with no trouble.

Manual

ICOM has done a good job with the IC-737 manual. As you move from front to back in the manual, you encounter information

[1]ICOM early advertising statements ("Tech Talk from ICOM," March 1993 *QST*, p 173) that the IC-737's notch operates at IF are incorrect.

mostly in the order you need it: table of contents, front- and rear-panel descriptions, installation instructions, basic operation, and so forth. Clear photographs and diagrams illustrate radio operation and add to the 60-page manual's utility.

Summary

The IC-737 is generally an excellent, highly polished radio. It's a nice size, sounds great on the air, does CW quite well and is a pleasure to use.

Aside from VOX for voice operation, two features I really miss (and that are present in most other ICOM radios) are a separate receive-antenna connector and a low-level output for driving a VHF/UHF transverter. Many MF/HF DX operators use separate low-noise antennas for reception, and most VHF/UHF operators use transverters for some of those bands. The IC-737 is otherwise so well suited to these two modes of operation that I'd have thought ICOM would include them in this radio. The good news is that, for those so minded, neither of these features is particularly difficult to add.

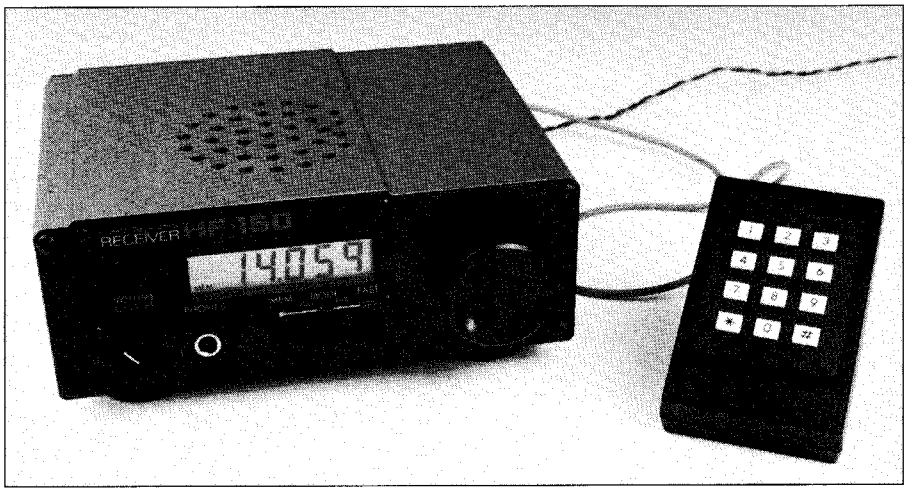
All things considered, I find the IC-737 an excellent mid-level transceiver that's well suited to almost every facet of MF/HF operation. Its lack of complexity makes it a good starter rig, and its collection of features makes it a smart upward move for those upgrading from a more basic platform.

Thanks to Dave Newkirk, WJ1Z, for his contributions to this review.

Manufacturer: ICOM America, Inc, 2380 116 Ave NE, Bellevue, WA 98004, tel 800-999-9877. Manufacturer's suggested retail prices: IC-737, $1599; PS-15 power supply, $219; FL-252A 500-Hz filter (455-kHz IF), $124; FL-53A 250-Hz filter (455-kHz IF), $124; FL-100 500-Hz filter (9-MHz IF), $83; FL-101 250-Hz filter (9-MHz IF), $80; CR-282 high-stability crystal oscillator, $108; UT-30 tone encoder, $21.

Lowe HF-150 LF/MF/HF Communications Receiver

Reviewed by David Newkirk, WJ1Z



And now for something completely different. I lead with this famous *Monty Python's Flying Circus* line because this review spotlights an unusual British radio: a communications receiver that covers 30 kHz to 30 MHz, receives CW, LSB, USB, AM and synchronous AM, and comes in an extruded-aluminum cabinet no larger than a cigar box. The little HF-150 has been roundly praised in shortwave-listening circles for its novel design, clean sound and operational simplicity. One of those radio amateurs who does as much (or more) SWLing as hamming, I welcomed the chance to get my hands on an HF-150 and see what the excitement was about.

Two Knobs, Three Buttons, One Switch

If control simplicity is the goal, the HF-150 is the radio I keep hearing hams say they dream about. The HF-150's front panel includes only **VOLUME ON/OFF** and tuning knobs; three buttons, a headphone jack, and a liquid-crystal display that indicates tuning mode (**MEM**ory or normal) and frequency to the nearest kilohertz.

The rear panel includes jacks for antenna, frequency-entry keypad, line-level audio (for a tape recorder), external speaker, and dc power jacks; two slide-in/out battery trays (four AA cells each); spring-loaded wire-antenna terminals; and a **WHIP/NORM/ATTEN** antenna slide switch. A 2½-inch speaker fires out through holes in the radio's top.

That, brothers and sisters, is it. There's no S meter, no IF-filter or AGC-select buttons, no RIT, no constant mode indication, no narrowband FM, no scanning functions, no noise blanker. There are no hidden menus, power-up or otherwise; no jumpers, no add-on filters. The HF-150's display isn't even backlit! The closest to "Las Vegas" *this* radio gets is to display its model number at power-up and **LoPr** if its supply voltage (be it from internal batteries or an external source) drops too low.

Much of the HF-150 hubbub seems to center on the clever design approach embodied in the set's **MEM, MODE/ReCaLl** and **FAST/STOre** buttons. Press **MEM**, and the HF-150's tuning knob tunes bidirectionally through the radio's 60 memories, during which operation the LCD displays memory-channel number instead of frequency. (If you wait a second after selecting a memory channel, the display switches to showing that channel's stored frequency. Stored mode is not indicated.) Once you select a memory channel, the display switches from channel number to frequency after about a second. You press **MEM** again to leave memory mode, or **RCL** to recall that channel. Writing a memory channel involves much the same process; instead of **RCL**, you press **STO**.

Pressing **MODE/RCL** lets you move bidirectionally through the HF-150's LSB, USB, AM wide and AM narrow, and four synchronous-AM modes: double sideband, hi-fi double sideband, lower sideband and upper sideband. The LCD displays corresponding mode identifiers during this process and returns to frequency display if you wait a few seconds (sooner if you press **MODE/RCL** again).

Pressing **FAST/STO** makes the tuning knob tune in 100-kHz steps. Pressing **FAST/STO** again exits this mode. Otherwise, the tuning knob tunes in 8-Hz steps in the SSB and synchronous-AM modes, and 60-Hz steps in the envelope-detection AM modes. Turning the tuning knob faster increases the tuning rate—supposedly in all modes, but (as other reviews have mentioned) not in the SSB modes, despite what the HF-150 instruction manual says. Like the Sony receivers that feature synchronous AM detection, the HF-150 automatically switches from sync to envelope AM if you tune rapidly in sync mode—a convenience for fast bandscanning.

The HF-150's rear-panel **WHIP/NORM/ATTEN** switch interacts with the set's **50 & WHIP** (SO-239 coaxial jack) and **WIRE AERIAL** (spring-loaded terminal) inputs as follows: The **50 & WHIP** input is available in all three positions. A JFET preamp is in line

The Bottom Line

A good performer in an unusually portable package, the HF-150 combines very simple operation with a solid group of features. It's not priced at the low end of the spectrum, however.

Table 2
Lowe HF-150, Serial Number 124358

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: 0.03-30 MHz.	As specified.
Modes of operation: AM, LSB, USB.	As specified.
Power requirement: 12 V dc at 130 to 300 mA.	420 mA at maximum audio output with 12-V supply.
SSB sensitivity (10 dB S+N/N): 0.5-30 MHz, 0.5 μV (–113 dBm—preamp off), 0.2 μV (–121 dBm—preamp on); 0.03-0.5 MHz, 1 μV (–107 dBm).	Minimum discernible signal (MDS), 2.7-kHz IF filter: *Preamp Off* / *Preamp On* 225 kHz: –128 dBm / –133 dBm 1.0 MHz: –130 dBm / –135 dBm 3.5 MHz: –129 dBm / –134 dBm 14.0 MHz: –128 dBm / –135 dBm 28.0 MHz: –126 dBm / –137 dBm
AM sensitivity (10 dB S+N/N): 0.5-30 MHz, 1 μV (–107 dBm—preamp off), 0.3 μV (–117 dBm—preamp on); 0.03-0.5 MHz, 2 μV (–101 dBm).	Minimum discernible signal (MDS), 6-kHz IF filter: *Preamp Off* / *Preamp On* 225 kHz: –115 dBm / –121 dBm 14 MHz: –115 dBm / –123 dBm
Blocking dynamic range: Not specified.	Blocking dynamic range with 2.7-kHz IF filter:* *Preamp Off* / *Preamp On* 1.0 MHz: 106 dB / 103 dB 3.5 MHz: 104 dB / 103 dB 14.0 MHz: 109 dB / 106 dB 28.0 MHz: 108 dB / 106 dB
Two-tone, third-order intermodulation distortion dynamic range: with narrow filter at unspecified test frequency, 90 dB at 50-kHz signal spacing, 87 dB at 20-kHz spacing, 70 dB at 10-kHz spacing.	Third-order IMD dynamic range with 2.7-kHz IF filter:* *Preamp Off* / *Preamp On* 1.0 MHz: 90 dB / 85 dB 3.5 MHz: 90 dB / 86 dB 14.0 MHz: 89 dB / 86 dB 28.0 MHz: 89 dB / 85 dB
Third-order input intercept: with narrow filter at unspecifed test frequency, 7 dBm at 50-kHz spacing, 4 dBm at 20-kHz spacing, –20 dBm at 10-kHz spacing.	*Preamp Off* / *Preamp On* 1.0 MHz: 2 dBm / –6 dBm 3.5 MHz: 6 dBm / –5 dBm 14.0 MHz: 6 dBm / –6 dBm 28.0 MHz: 6 dBm / –11 dBm
Spurious responses: ">65 dB rejection of images, IFs, etc."	2nd-IF image rejection (signal frequency +910 kHz), preamp off, 74.8 dB; preamp on, 73.1 dB.
Receiver audio output: More than 1.6 W at 5% THD into 8 Ω.	2.65 W at 10% THD into 8 Ω.
Frequency response: (–6-dB bandwidths) SSB mode, 170-2800 Hz; AM, 30-3300 Hz; ASF, 20-5500 Hz.	IF/audio response: at –6 dB: SSB, 303-2940 Hz (2637 Hz); AM wide, 64-3300 Hz (3236 Hz); AM narrow, 61-1000 Hz (939 Hz); ASF (hi-fi synchronous mode), 63-4200 Hz (4137 Hz).
Synchronous detector locking range: DSB, ±100 Hz; SSB, ±50 Hz.	As specified.

Size (height, width, depth): 3.2 × 7.2 × 6.5 inches; weight, 3 lb.

*Dynamic-range measurements were made at the ARRL Lab standard signal spacing of 20 kHz.

with this input when **WHIP/NORM/ATTEN** is set to **WHIP**, and a resistive attenuator is in line with this input only when **WHIP/NORM/ATTEN** is set to **ATTEN**. The **WIRE AERIAL** input (impedance, nominally 600 Ω) is available when **WHIP/NORM/ATTEN** is set to **NORM** and **ATTEN**.

The idea is not to have antennas connected to the **50 & WHIP** and **WIRE AERIAL** inputs simultaneously. This is important: The HF-150 uses *no front-end filtering aside from anti-image low-pass filtering.* This means that the radio's first mixer, a Plessey SL6440C IC, receives signal energy from *the entire LF/MF/HF spectrum simultaneously*, as modified only by antenna-system response.

On the Air with the HF-150

Although it includes a finger hole, the HF-150's large, smooth, machined-aluminum tuning dial cannot be spun freely because it drives a shaft encoder that feels like someone poured honey into the works. Some might call this Smoothness Personifed, but I find it frustrating because it feels vague. In USB and LSB, the HF-150's tuning gooeyness is magnified by a glacially slow (1.6 kHz/rev) tuning rate. (Am I actually tuning, or or my fingers slipping on that ultrasmooth dial?)

In the radio's heterodyne-detection modes, the LCD doesn't provide sufficient tuning feedback because it displays only to the nearest kilohertz. But the radio's sludgy tuning feel can't fully obscure the set's rock-solid synthesized tuner. (The HF-150 manual mentions using the set for RTTY and fax reception, and I do not doubt that the HF-150's selectivity and stability are sufficient for such service.) The optional keypad, though pricey, offers the friendliest and fastest direct-frequency/memory entry I've used yet. The radio can also be computer-controlled via its keypad jack.

Weeks of roaming the LF/MF/HF spectrum with the HF-150 prove it to be plenty sensitive, as ARRL Lab tests confirm. What it needs is a stronger front end. (Our tests suggest this, also.) Just about anything a ham would call "a real antenna" causes significant intermodulation[2] and/or cross-modulation[3] in the HF-150, especially at night. The **WHIP/NORM/ATTEN** switch's **ATTEN** position helps, but it's no substitute for better dynamic range.

The HF-150's lack of input filtering makes it susceptible to second-order intermodulation distortion (in addition to the third-order IMD we routinely measure in the ARRL Lab). Second-order IMD results in simple addition and subtraction of input-signal frequencies (example: 9.59 MHz + 11.685 MHz = 21.275 MHz). Most current ham-band transceivers include filtering that band-limits input signals to reduce this effect, but the HF-150 does not. Sure enough, at night, connecting the HF-150 to a 7-MHz half-wavelength dipole revealed numerous spurious signals in the 21-MHz region as I zeroed in on Radio Australia at 21.74 MHz. The HF-150's input attenuator can help, but the *real* fix for this is *input filtering*. Switching to a 15-meter half-wave dipole would have helped (that's a form of filtering, too!).

The HF-150 manual specs the receiver's 6-dB bandwidths as 6.5 kHz (wide) and 2.6 kHz (narrow), at a 60- to 6-dB shape factor of 1.6. Through all of my many hours of HF-150 tuning and despite the radio's high AGC compression, I heard no filter blow-by (stopband leakage of strong signals) whatsoever, even in the HF-150's highest-fidelity mode. So I consider the HF-150's IF filtering to be good.

That said, the HF-150's distinctly different USB and LSB audio pitches take some getting used to—the upper sideband sounds somewhat trebly compared to the bassier lower sideband. Although *some* sideband-pitch difference due to slight passband asymmetry is common in two-way SSB radios, the HF-150's pitch difference is built right in: the radio derives its 455-kHz BFO signals by dividing an HF oscillator, and the resulting USB and LSB values aren't equally offset from its IF-filter center.

[2]Intermodulation causes strong on-air signals to mix in your receiver and produce fake signals that you hear, but that aren't really on the air.

[3]Cross-modulation causes the program audio from one or more strong, off-channel stations to be superimposed on the signal to which your radio is tuned.

The HF-150's AGC pops irritatingly when a strong signal appears with the receiver operating at maximum IF gain. Shortwave listeners may never notice this because broadcast signals' constant carriers tend to keep receiver gain down, but two-way communicators who listen to SSB and CW signals may wince. The '150 has one, mode-independent AGC decay time: *s l o w*.

As mentioned earlier, the HF-150 includes synchronous AM detection as one of its selling points. The HF-150 uses IF selectivity, not phasing, for sideband selection in its synchronous detection—a good thing. The receiver is capable of providing startlingly clear AM reception in its double-sideband and hi-fi double-sideband modes, and combating adjacent-channel interference in its sideband modes. But almost as startling is the detector's tendency to instantaneously lose lock on strong, relatively nonfading signals, apparently in response to modulation peaks. I wish Lowe would have a look at this, because it mars the HF-150's otherwise sparkling audio/detection performance. Refreshingly, the '150 includes one of the most hiss-free AF-output chips I've heard in quite a while.

The HF-150 includes no signal-strength meter! What a concept: Evaluate radio-signal reception quality by listening to *how the signal sounds* at the receiving end. Yes, I'm out of the closet: I consider S meters that aren't calibrated in absolute units—say, microvolts per meter, but I'd settle for dBμV—to be a waste of panel space. So I won't tag the HF-150's lack of one as a problem. But more than a few hams may feel otherwise.

The HF-150's 32-page manual includes the receiver's schematic and a brief description of how the circuitry operates. In all, it's complete, literate and entertaining.

Conclusions

Provided with just sufficient antenna RF and no more, the HF-150 is a good shortwave-broadcast performer. *Of course* it performs better in this service than SWL portables—it's a tabletop set (and priced pretty much like one) that uses a front-end circuitry aimed at better-than-portable performance. But put a "real" antenna on the HF-150—even a dipole—and you'll need its built-in attenuator much of the time. That's disappointing, considering the radio's price and promise.

The HF-150's AM envelope detection sounds as good as the best I've heard.

I rate the HF-150's synchronous AM detection as fair to good. It unlocks too often for an unqualified *good*, and its overly narrow lock-in range keeps it from immediately locking on exact-frequency punch-ins (as in jumping to, say, BBC-5975)—I often had to use the tuning knob to achieve detector lock after keypad excursions. Looking to tomorrow, the HF-150's synchronous detector doesn't routinely succeed in achieving and holding lock on reduced-carrier SSB signals, so it isn't your passport to the SSB_{-12} broadcasting said to be in shortwave's future.

As an SSB and CW receiver, the HF-150 is fair to excellent: *fair* if I compare it to quality amateur gear, which generally affords higher dynamic range, smoother (and selectable) AGC, and more selectivity options. It's *good* to *excellent* if I compare it to SWL portables. AGC issues aside, few Amateur Radio receivers receive SSB with a fidelity so high as the HF-150. Within the limitations imposed by its noisy synthesizer and modest dynamic range, an HF-150 could reasonably serve as the receiving part of an amateur MF/HF station, especially for conversational SSB.

The HF-150 is fairly pricey. A lateral cross-market look reveals receive-only ham-transceiver spinoffs offering more AGC and filtering options and better dynamic range, albeit without synchronous detection, that almost make it down to the HF-150's price range. But if you need an unusual portable LF/MF/HF receiver with better-than-portable performance, the HF-150 is worth your careful consideration. No other LF/MF/HF radio I know of fits so much good listening quality into in such a totable package.

Overall, I wish I didn't have to put this one back in the box!

Manufacturer: Lowe Electronics, Chesterfield Rd, Matlock, DE4 5LE, United Kingdom, tel 44-629-580800, fax 44-629-580020. Manufacturer's suggested prices: HF-150, $599.95; frequency-entry keypad, $99.95; 12-V power supply, $19.95; computer interface and cable, $99.95; accessory kit (whip antenna, eight AA NiCd batteries, brackets, carrying handle, shoulder strap with built-in antenna, adhesive feet), $99.95. QST

New Products

FOXHUNTING AND ATV GEAR

◊ VHF/UHF operators will want to get the latest literature about a variety of equipment for radio direction finding ("foxhunting"), amateur television and transverters from MAS Enterprises. For the "fox," there are specially designed 2-meter transmitters ($249), amplifiers (from $53) and near-omnidirectional halo antennas ($49); and for the hunters, receivers with switchable sensitivity, manual RF gain controls and signal-strength meters ($238) and directional antennas ($75). For ATVers, there are 23-cm FM transmitters (from $75) and amplifiers (from $125). You can also find sequencers ($125), semiconductors ($1.38-$125), antenna duplexers ($36), 6-meter transverters ($249) and more. (Prices are US dollars, based on approximate conversion from Canadian dollars.) Many items are available assembled or as kits. Manfred Zielinsky, VE3ZIE, MAS Enterprises, 104 King St S, St Jacobs, ON N0B 2N0, Canada; tel 519-664-1273, fax 519-664-3082.

AMIGA CODE TUTOR

◊ *CopyCode* is a Morse code training program written for Amiga personal computers. All controls, including tone frequency, volume, weight, character formation and transmission speeds, lesson length, and hide/show text may be set using the mouse. It contains all the characters on the FCC license exams and more, with 14 predefined character groups and the user can create custom groups with the unique onscreen keyboard. *CopyCode* contains thousands of sequences of characters, words, Q signals, CW abbreviations and sample QSOs. Multiple copies may be run to simulate QRM. Retail price is $23 including shipping (California residents add sales tax). Bob Galka, KY6P, Sensible Software Solutions, 4951-D Clairemont Sq, Suite 262, San Diego, CA 92117-2798; tel 619-452-1938.

RTTY CONTEST SOFTWARE

◊ The latest release of the *RTTY by WF1B* contesting program, version 2.09, now includes a DXpedition mode, support for the AEA AMT-1 AMTOR terminal unit, and improved support for the HAL PCI-3000 adapter card. It also works with the AEA PK-232, Kantronics KAM, MFJ-1278 and several "older-style" terminal units. It's configured for operation during the ARRL, *CQ*WW, BARTG and SARTG contests. A computer BBS is available for downloading new releases, enhancements and upgrades. Retail prices is $41.95 (Rhode Island residents add sales tax). Ray Ortgiesen, WF1B, Wyvern Technology Inc, 35 Colvintown Rd, Coventry, RI 02816-8509; tel 401-823-7889, CompuServe 73750,2177.

REPEATER-CONTROL ADD-ONS

◊ Users of the MCC RC-1000 repeater controller can add the VID-1 voice ID module. It provides up to 20 seconds for user-recorded "real-voice" IDs and announcements and can be changed remotely. The single-board circuit comes complete for $89.95.

Another enhancement is the Revision 3.00 software upgrade for the RC-1000, with 32-number autodial, dual-tone multifrequency (DTMF) access, an "antiker-chunker," reverse-patch signal mode and more. The upgrade is $49.95. The RC-1000 retails for $239.95. Ron Wright, N9EE, Micro Computer Concepts, 1825 E 109th Ave, Tampa, FL 33612; tel 813-977-3547. QST