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The ICOM IC-2800H Dual-Band FM Transceiver

The ADI AR-147 VHF FM Mobile Transceiver

Tower Jack Tower Tools

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Edited by Joe Bottiglieri, AA1GW • Assistant Technical Editor

The ICOM IC-2800H Dual-Band FM Transceiver

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I must admit that the first aspect of the IC-2800H that caught my attention was not which bands it covered or whether it would fit in the space available in my pickup. Just like nearly everyone else who sees this unit for the first time, I was mesmerized by its TV screen style display.

Several of the recently released transceivers in ICOM's HF product line feature displays that conform to the familiar proportions of a typical television or monitor screen—but these use the more conventional LCD arrangements. Information is represented by a combination of activated monochromatic segments on a contrasting background.

The IC-2800H is the first Amateur Radio transceiver to use a TFT color LCD screen—essentially identical to those found on pocket-sized color TVs. The result is a new level of display flexibility—any color, any shape, anywhere in the window. A setting in the programming menu allows you to select from several different color schemes. You can even plug in an external NTSC video source, such as a camcorder, VCR or ATV receiver, and use the display as a color video monitor screen.

But Wait—It's a Radio Too!

Before your mind wanders off to dream up alternative applications for the display, let's have a closer look at the radio itself.

The IC-2800H is a dual-band 2-meter/70-cm FM mobile transceiver. Highlights include 99 regular memories per band, alphanumeric tagging, expanded VHF receive, remote control from the microphone, four power output settings, CTCSS encode and decode, tone scan, twin band scopes, 14 DTMF memories and 1200/9600 bps packet capability.

Add to this list "true" dual band operation. There are separate receivers for the VHF and UHF bands with two independent sets of controls. You can transceive on one band while you monitor activity on the other—or even operate crossband full duplex. The radio is incapable, however, of simultaneously receiving two signals within the same band (ie VHF/VHF or UHF/UHF operation).

Installation

Unlike similar FM mobiles that are delivered as an integrated chassis/display unit and offer a separation kit as an optional



accessory, the IC-2800H consists of two distinct components: the chassis and the controller/display unit. The controller/display does not snap on to the chassis. Individual head and chassis mounting brackets and an 11.5-foot interconnection cable are provided.

The control head is a bit taller than the faceplate portions of most mobile FM transceivers, primarily due to the 3-inch diagonally measured display screen. A speaker is mounted inside—the speaker grill is on the back. The interconnection cable snaps into an RJ12 jack in a recess in the back of the head. An RCA jack, for plugging in an external video source, is located on the right side.

The chassis is essentially a hollowed-out block of cast aluminum with a good measure of fin area and a sheet metal cover on the bottom. The rear panel has a chassis mounted SO-239 antenna connector, two 3.5 mm external speaker jacks and a pigtail with a conventional T-type dc power connector. A cooling fan forces air into the back of the enclosure and out through vents in the front. This cabinet looks *plenty* rugged.

The front panel of the chassis contains an RJ45 microphone jack, an RJ12 jack for the control head interconnection cable and

Bottom Line

The IC-2800H combines state of the art dual-band FM communications capabilities with cutting-edge display technology. Its ability to serve as a monitor screen for externally generated images will certainly provide the motivation for interesting alternative applications.

a 6-pin mini-DIN packet data connector.

Mobile installation of this transceiver is fairly straightforward—but there are some limitations. Since the microphone cable plugs into the chassis, you'll need to position it within mike cord distance of your operating position—about 4 feet or so.

With the included mike wiring, chassis mounting options are probably restricted to under the dash or beneath or between the front seats. While this is fine for my pickup truck, if you desire more flexibility (trunk mounting for example), you may need to purchase optional extension cables for the microphone and/or interconnect cable. An optional 23-foot dc power cable is also available—the included dc cable is about 10 feet long.

The IC-2800H's mounting system makes it attractive to those who want to use one radio in a variety of applications—mobile, base and portable for example. Since all the cabling, except the antenna connection, uses either plugs or telephone-type connectors, it's fast and easy to unhook the wiring and pull out the components. The provided chassis bracket secures with four screws, but an optional quick-release bracket is also available. The control head fastens to its bracket using a single screw with a large knurled head. Loosen the screw, unsnap the RJ12 connector, and the remote control head is free.

The Remote Controller

The control head contains the center-mounted screen, 6 knobs and 10 buttons. The areas on either side have matching sets of controls. The volume, squelch and encoder knobs for each band are positioned along the outer edges of the front panel. A

Table 1

ICOM IC-2800H, serial number 01357

Manufacturer's Specifications

Frequency Coverage: Receive, 118-174 MHz, 430-450 MHz; transmit, 144-148 MHz, 430-450 MHz.

Power requirements: 11.7-15.9 V dc; receive, 1.8 A; transmit, 12.0 A (max, high power).

Size (hwd): main unit, 1.6x5.5x6.5 inches; weight, 2.6 pounds; remote controller, 2.8x5.5x1.3 inches; weight, 10.2 ounces.

Receiver

Sensitivity: 12 dB SINAD, 0.16 μ V.

Two-tone, third-order IMD dynamic range: Not specified.

Adjacent-channel rejection: Not specified.

Spurious response: 60 dB.

Squelch sensitivity: 0.13 μ V.

Audio output: 2.4 W at 10% THD into 8 Ω .

Transmitter

Power Output: (H / M / L), VHF, 50 W / 20 W / 10 W / 5 W; UHF, 35 W / 20 W / 10 W / 5 W.

Spurious signal and harmonic suppression: 60 dB.

Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.

Receive-transmit turnaround time ("tx delay"): Not specified.

Bit-error rate (BER), 9600-baud: Not specified.

Measured in ARRL Lab

Receive and transmit, as specified.

Receive, 1.2 A (max volume, no signal); transmit, 8.9 A, tested at 13.8 V.

Receiver Dynamic Testing

FM, 12 dB SINAD, VHF and UHF, 0.14 μ V.
AM, 10 dB S+N/N, 120 MHz, 0.5 μ V.

20 kHz offset from 146 MHz, 68 dB*,
10 MHz offset from 146 MHz, 88 dB;
20 kHz offset from 440 MHz, 67 dB*,
10 MHz offset from 440 MHz, 74 dB.

20 kHz offset from 146 MHz, 68 dB;
20 kHz offset from 440 MHz, 67 dB.

IF rejection, VHF, 129 dB, UHF, 122 dB;
image rejection, VHF, 69 dB; UHF, 80 dB.

At threshold, VHF and UHF, 0.06 μ V.

2.8 W at 8% THD¹ into 8 Ω .

Transmitter Dynamic Testing

146 MHz, 50 W / 18 W / 8.7 W / 4.3 W;
440 MHz, 36 W / 18 W / 9.3 W / 4.3 W.

VHF, 70 dB; UHF, 64 dB. Meets FCC requirements.

Squelch on, S9 signal, VHF and UHF, 210 ms.

VHF, 150 ms; UHF, 200 ms.

146 MHz: Receiver: BER at 12-dB SINAD,
2.5 $\times 10^{-3}$; BER at 16 dB SINAD, 2.7 $\times 10^{-4}$;
BER at -50 dBm, <1.0 $\times 10^{-5}$; transmitter:
BER at 12-dB SINAD, 2.6 $\times 10^{-3}$; BER at
12-dB SINAD + 30 dB, 3.1 $\times 10^{-4}$.

440 MHz: Receiver: BER at 12-dB SINAD,
3.1 $\times 10^{-3}$; BER at 16 dB SINAD, 4.2 $\times 10^{-4}$;
BER at -50 dBm, <1.0 $\times 10^{-5}$; transmitter:
BER at 12-dB SINAD, 3.6 $\times 10^{-3}$; BER at
12-dB SINAD + 30 dB, 6.9 $\times 10^{-4}$.

*Measurement was noise limited at the value indicated.

¹With the steps in the volume control, 10% THD could not be produced; the next higher step resulted in 12% THD.

column of four "soft" control keys, mainly for the VHF band, is situated along the left edge of the screen; a similar set for the UHF band is to the right.

Soft key assignments change under various programming conditions. The corresponding labels appear next to them in the display window. As with most late-model ICOM radios, no function button is required to activate the secondary key operations shown on the labels. Press and hold the button for a couple of seconds and the second item is accessed.

The two remaining front panel buttons are located at the bottom edge of the controller. A **CHG/L** key, for toggling between the two sets of main assignments for the soft keys (or to lock the keys), is on the left. A **POWER** on/off key is on the right.

The relatively large front panel allows for generous spacing between the knobs and buttons. This layout, the separate control sets for each band and the electronic key labels make the IC-2800H reasonably

easy to operate even while mobile—particularly at night. I did find the factory default settings for the display a bit too bright for nighttime mobile use, but a menu setting allows adjustment of the brightness and contrast.

I recommend that you take some time and do a little experimenting before you choose a permanent location for mounting the remote controller. As with the conventional LCD-type displays, glare from direct sunlight and positions that result in extreme off-angle viewing can impair your ability to see the screen clearly.

Display information for the VHF band appears in the upper half of screen, with soft key labels for VHF functions along the left edge. UHF band information and key labels are shown in the lower half and on the right edge of the screen. Each portion displays the operating frequency, the power output setting and icons that indicate duplex and CTCSS settings. When you're in the memory mode, the memory channel

number is indicated. If you've turned on the "Memory Name" option in the set menu, a programmable alphanumeric tag (up to 8 characters long) can also be displayed. The tag appears just above the frequency digits.

In the factory default setting, the display background is dark blue—the VHF band information appears in yellow and the UHF information appears in green. Three other alternative formats are available, including a stylized version that features highlights and shading.

Microphone Control

US versions of the IC-2800H come with ICOM's HM-98 microphone. This mike offers an impressive array of control capabilities.

Seven keys are mounted on the upper portion of the front of the microphone. These allow you to switch between VFO, call channel and memory operation and to toggle the active band between VHF and UHF. Large

▲ and ▼ keys let you step through the VFO frequencies or memory channels. Hold either of these for a couple of seconds and the scan function will be activated. There are also **F-1** and **F-2** keys that can be programmed to mimic your choice of a wide variety of the radio's other buttons.

The lower front portion contains a separate keypad area hidden under a snap on cover. Here you'll find 18 additional keys including a **FUNCTION** button, a **DTMF** button and a typical 4-column/4-row DTMF keypad. Each of the keys located in the keypad field can perform three different operations. The DTMF tone assignment and the primary function label are printed on the surface of the button. The secondary function label is printed above each button and is accessed by first pressing the **FUNCTION** button.

Once you've programmed this radio's menus, the microphone can be used to control virtually all operations. Control highlights include direct frequency entry, volume and squelch, mute, power output, CTCSS, duplex, monitor, autodial, scan and lots more. All keys are backlit for nighttime operation.

An infrared wireless microphone, the HM-90, is also available as an optional accessory. Information in the manual indicates that this mike offers capabilities very similar to the included HM-98.

Programming

I spent some time with the unit temporarily set up in my shack so that I could explore the features, load up a few memories and get accustomed to the programming and operating schemes.

The supplied *Instruction Manual* is well written and logically organized. It starts out with an extensive *Table of Contents*. The first few sections provide numbered diagrams of the controller unit's knobs and keys, the jacks on the main unit, the various display icons and the control buttons on the HM-98 microphone. Short descriptions of each item and page references for more complete explanations are provided. A section on installation considerations follows.

The body of the manual gives step by step descriptions for programming and operating the transceiver. For those features that can be controlled from either the controller or the microphone, information on the procedures for both methods is listed together.

The final few sections include instructions for packet operation, connecting external video sources, computer programming (using optional cabling and *Windows* software) and troubleshooting. The last two pages list specifications.

Operating and programming the IC-2800H may seem a little intimidating at first, but after you play with this transceiver for just a few minutes, you'll find that the information that pops up on the screen helps guide you through the steps.

Each band has its own "edit" menu. Press and hold the **MAIN/EDIT** button and a table of three menu selections appears. These include the CTCSS encode tone, the CTCSS decode tone and the repeater offset settings. Labels next to the soft keys let you know which keys you'll need to press to scroll to the desired menu item. The UHF encoder knob is used to vary the settings. If you are in the memory mode when you enter this menu, you'll also see a menu selection for naming the memory.

Press the **DISPLAY/SET** key and you'll enter the display menu. Here you'll find the controls for the display format, the brightness and contrast and a setting where you can enter an alphanumeric sequence—your call sign for example—that will appear when you first turn the power on. Press and hold the **DISPLAY/SET** button and you enter the initial set menu. This table contains 16 listings including auto power off and time out timers, packet data rate, RF attenuator, cooling fan (on or automatic), and the assignments for the **F-1** and **F-2** microphone keys. The menu titles in most cases are spelled out clearly—the setting for the cooling fan reads "Cooling Fan," for example. It's easy to tell what's currently on the menu without having to refer to the manual for a translation.

Features

The IC-2800H also includes a number of advanced features.

There are two independent band scopes—one for each band. In the VFO mode, the scope will display the relative receive signal strength on 21 frequency steps, 10 on either side of the operating frequency. In the memory mode, the graph will show the signal strength on 10 memories to either side of the currently selected memory. Turning the encoder knob will move the operating frequency up or down the band or step through memory channels. You can make a single sweep and then stop, or set the unit to continuously sweep until you stop it manually. Audio is muted during the sweep.

VHF receive capability ranges from 118 to 174 MHz. Tuning below 136 MHz automatically activates the AM receive mode. AM can also be manually engaged or disengaged on any frequency with a setting in the menu. The receive coverage in the UHF band, however, is limited to 430-450 MHz.

The '2800H offers several different scan modes. You can activate a scan that will cover the entire VHF or UHF band; the aircraft, amateur or public service portions of the VHF band; or between three pairs of user-programmable frequency limits. You can even program the scan to skip specific frequencies within the VFO scanning range. Memory channels can also be scanned, and selected memories can be locked out. Scan resume conditions can be based on frequency activity—or the pause duration on a busy frequency can be set to 5, 10 or 15 seconds.

Additional features include scratch pad

memories. These automatically retain the last five simplex and the last five duplex frequencies that you transmitted on while in the VFO mode. You can easily transfer this collected data into the regular memory banks.

There's a priority system that can check for activity on a specific memory or call channel frequency, or watch for activity as it steps through the memories, while you are operating in the VFO mode.

An automatic RF attenuator can be activated in the set mode. This provides up to 10 dB of attenuation as the squelch control is rotated past the 12 o'clock position and helps combat intermod.

An auto repeater offset system is also included. When this feature is engaged, the repeater offset directions for the VHF and UHF bands will automatically change in accordance with the US band plans.

Operational Observations

I found the transmit and receive performance of the IC-2800H to be very good. I consistently received reports of clear, natural sounding transmit audio. The receive audio quality is quite good—even when using the remote controller's relatively small built-in speaker. In spite of the fact that the speaker audio exits through the back side of the head, the volume and clarity of the audio was more than adequate for windows-down mobile operation—even in my somewhat noisy pickup.

While the cooling fan does make a bit of a racket, I didn't find it particularly objectionable. You can program the fan to run continuously or for 2 minutes after each transmission. In my mobile mounting arrangement, the chassis was positioned far enough away so that I barely noticed the whir. In a base station application, it should be a simple matter to locate the chassis such that the level of sound at the operating position would be minimized.

I did notice that the display unit generates a considerable amount of heat. While it feels pretty warm to the touch, it never gets hot enough to raise any major concerns. Another HQ staffer had the opportunity to try an early production IC-2800H back in March of this year. He had the unit temporarily installed in his car. He reported that with extremely cold vehicle cabin temperatures, the display was difficult to read until it began to warm up. This typically took less than a minute.

As I mentioned earlier, the default screen brightness level is too high for nighttime mobile operation, but daytime viewing really requires the higher settings. While it's a fairly simple matter to go into the menu and change the setting, it sure would have been convenient if the radio sensed the ambient lighting level and adjusted the brightness accordingly.

ICOM has spoiled us by providing two separate microphone connection points on their IC-706 series HF radios—one on the

back of the chassis and one on the removable faceplate. A second microphone jack (and perhaps at least one speaker/headphone jack) on the remote controller of the IC-2800H would have been a welcome addition.

ARRL lab testing revealed some interesting numbers. I expected to find that the current consumption for this unit, especially in the receive mode, would be significantly higher than similar radios using more conventional display technology. Surprisingly, this was not the case. The current requirement is just slightly greater than average.

Two-tone third-order IMD dynamic range at 10 MHz offset for the VHF band measured a very respectable 88 dB—near the top of the class in comparison to some of the other recently reviewed dual-band transceivers. Numbers in this range typically indicate a high level of resistance to intermod from strong nearby VHF paging and commercial communications.

The Screen

All right then, let's get back to that cool display!

Just for kicks, I plugged the video output cable of my ancient video camera/recorder unit into the RCA video socket on the remote controller and activated the video monitor function in the transceiver's display menu. Sure enough, live color scenes of my shack's interior appeared on the screen. Considering the relatively small size of this display, picture clarity wasn't too bad—pretty much on par with what I've seen on those pocket TVs.

Some possible uses for this display capability that come to mind include mobile SSTV. Connect a scan converter, the Tasco TSC-70U for example (see *Product Review* April 1997), and use it in conjunction with your camcorder or one of those inexpensive miniature cameras to transmit and receive still pictures on the VHF or UHF band. You could also connect the display to ATV equipment, such as

the PC Electronics TC70-10 ATV transceiver (see *Product Review* December 1998) for fast scan television viewing.

The transceiver will still operate while the display is in the external video mode. You can switch back to the radio screen to check and change operational setting with a couple of quick button presses.

I'll leave additional applications to your fertile imaginations.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004, tel 425-454-8155; fax: 425-454-1509; <http://www.icomamerica.com>. Manufacturer's suggested retail price: IC-2800H, \$670. Typical current street price, \$550. MB-17A quick release mobile mounting bracket, \$49; OPC-872 controller extension cable (11.5 feet), \$27; OPC-647 microphone extension cable (8.2 feet), \$54; OPC-347 dc power cable (23 feet), \$46; CS-2800 *Windows* cloning software, \$13; OPC-478 cloning cable, \$45.

The ADI AR-147 VHF FM Mobile Transceiver

*Reviewed by Joe Bottiglieri, AA1GW
Assistant Technical Editor*

Set ADI's latest 2-meter FM mobile radio—the AR-147—next to their previous model in this series—the AR-146—and you'd be very hard pressed to tell them apart. The faceplates and cabinets of the two transceivers are virtually identical; the most salient difference is the new unit's microphone. While the '147 borrows heavily from the parts bin of its predecessor, the engineers at ADI have managed to pack a significant number of new tricks between those familiar looking covers.

Features and Improvements

The AR-147 is a very well equipped 2-meter FM mobile transceiver. Features include 80 memories, three power output levels, CTCSS and DCS tone encode and decode, tone scan, code scan and expanded VHF receive from 118-180 MHz. You also get automatic repeater offset, remote control from the microphone (including keypad frequency entry), a DTMF tone reader, 9 DTMF autodial memories and multiple scanning and paging modes.

If you have a look back at our evaluation of the AR-146 that appeared in a *QST* *Compares* roundup in our November 1996 *Product Review* column, you will discover that in spite of the uncanny resemblance, the updated version of this radio is significantly different. New capabilities have been added and some of the existing features have been enhanced.

Particularly notable is the addition of digital code squelch (DCS). DCS is an alternative tone access system to the ubiquitous continuous tone code squelch system (CTCSS). DCS is gaining popularity in com-

mercial communications applications—primarily due to the greater number of available codes. I've yet to encounter a single amateur repeater requiring DCS for access, but it's conceivable that the technology will eventually begin to trickle down. In the meantime, scanner listeners will find this feature useful for sorting out shared-channel public service and commercial communications. For those already familiar with DCS—yes, the inverse codes are supported.

The ability to scan for access tones—CTCSS or DCS—is also new. You can pro-

gram the radio to identify the specific tone or code in use by scanning for them on the repeater's input frequency while other users are accessing the system.

Also new on this updated model is AM aircraft band receive. The AR-147 treats 118 through 136 MHz as a separate band, making it easy to tune through or scan these frequencies (or the second "band"—130 through 180 MHz) without the need to manually program in frequency limits.

The total number of memories in the '147 is double that of the earlier model. This is a welcome addition, especially considering the increased receive frequency range. Alphanumeric memory tagging is still not available. As with the AR-146, you can switch the display mode to indicate channel numbers instead of the operating frequency. Nine DTMF autodial memories are included—up from zero in the AR-146.



Bottom Line

With the AR-147, ADI reinforces their reputation for offering sophisticated transceivers with respectable performance, top-end features and affordable pricing.

Table 2**ADI AR-147, serial number 9170000723****Manufacturer's Specifications**

Frequency Coverage: receive and transmit, 144-148 MHz.

Power requirements: 11.7-15.8 V dc; receive, 0.6 A; transmit, 12.0 A (max, high power).

Size (hwd): 1.6×5.5×6.5; weight, 2.7 pounds.

Receiver

Sensitivity: 12 dB SINAD, 0.18 μ V.

Two-tone, third-order IMD dynamic range: Not specified.

Adjacent-channel rejection: Not specified.

Spurious response: Not specified.

Squelch sensitivity: 0.1 μ V.

Audio output: 2.0 W at 10% THD into 8 Ω .

Transmitter

Power Output: (H / M / L), 50 W / 25 W / 7 W.

Spurious signal and harmonic suppression: 80 dB.

Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.

Receive-transmit turnaround time ("tx delay"): Not specified. 49 ms.

*Measurement was noise limited at the value indicated.

Measured in ARRL Lab

Receive, 118-136 MHz (AM), 130-180 MHz (FM); transmit, as specified.

Receive, 0.87 A (max volume, no signal);

transmit, 10.3 A, tested at 13.8 V.

Receiver Dynamic Testing

FM, 12 dB SINAD, 0.17 μ V. AM, 10 dB S+N/N, 120 MHz, 5.6 μ V.

20 kHz offset from 146 MHz, 63 dB*,
10 MHz offset from 146 MHz, 89 dB.

20 kHz offset from 146 MHz, 60 dB.

IF rejection, 112 dB; image rejection, 64 dB.

At threshold, 0.09 μ V.

2.9 W at 10% THD into 8 Ω .

Transmitter Dynamic Testing

146 MHz, 57 / 27 / 6.1 W.

70 dB. Meets FCC requirements for spectral purity.

Squelch on, S9 signal, 90 ms.

Automatic repeater offset, preprogrammed for the US band plan, is also new. Tune to a portion of the FM band where repeaters are common, and the radio will automatically set your offset direction.

The time out timer in the new unit has been vastly improved. While the '146 only provided one setting (30 minutes!), the '147 offers a range of six different settings between 1 and 30 minutes.

The updated microphone that's packed with the AR-147 looks remarkably similar to one that's included with the FM mobile transceivers of a well known competing manufacturer (perhaps ADI raided *their* parts bins as well!). While some may argue that it's a bit on the large side, no one can complain about the generous size, spacing or backlighting level of the keys.

This new microphone adds the ability to enter frequency digits on the 16-button DTMF keypad—very handy for quickly punching frequencies into the VFO. It also provides individual buttons for accessing the call channel, the VFO or the memories. A **MHz** button puts you in the direct entry mode or allows you to use the top mounted **UP** and **DN** buttons to change frequency in 1 MHz steps. Various combinations of pressing and holding these four buttons lets you toggle between "bands," activate a dual watch or enter the scan modes.

Although the microphone doesn't offer quite as wide a range of control capabilities as we've seen on some other radios, the typically needed operations are readily available through the microphone's controls.

Up Front

The LCD screen displays black segments on an amber background. The frequency digits and the various function icons, though small by today's standards,

are still easy to read at most angles. A large 14-segment S/RF meter stretches across the lower edge of the window.

The main encoder knob is in the lower left corner of the front panel. Two small knobs for the volume and squelch are located just to the right of the display. The surface of these knobs is just slightly textured—not quite enough to provide much traction, however.

Many contemporary transceivers are using fewer front panel controls and menus for programming. The AR-147 employs the more traditional function button and key method—essentially the same as that used on the AR-146.

The front panel contains 10 buttons. A row of small buttons—the **VFO/M>V**, the **MR/M** and the **MHz/LOCK** buttons—are mounted above the main encoder. The center button of the set projects out slightly. Two small barriers isolate the three keys. This makes it easy to locate them by touch.

This group of keys allows you to toggle between the VFO and memory modes, write VFO information to a memory, switch to 1 MHz tuning steps, lock the front panel keys, enter and exit the AM aircraft band and activate various scans.

A second similar pair of buttons is located above the 8-pin microphone connector on the right edge of the front panel. These are the **LOW/DIM** and **PWR** buttons. A barrier separates these keys as well. **LOW/DIM** is used to vary the RF output level and to change the display backlight intensity. The **PWR** key switches the unit on and off.

Below the display window is a row of five larger keys. These include the **FUNCTION** button, the **CALL** button, and the **SHFT/REV**, **TONE/DUAL** and **DTMF** buttons. Their primary operations are performed with simple key strokes. Each push of the

SHFT/REV button, for example, cycles you through the simplex, duplex and the automatic repeater shift modes (both + and - will appear in the display simultaneously when the auto mode is engaged). Pressing the **FUNC** key before a particular button will bring up its secondary operation. Pressing and holding the **FUNC** for a second or two before pressing specific buttons typically brings up a related setting such as the tone or code frequency or the repeater offset value.

All of the front panel controls have halos of light that appear around their perimeters. The function labels on the five lower keys are translucent. This lighting arrangement works well for nighttime operations.

Operating Impressions

Programming the AR-147 can be a little more challenging than we've come to expect with the average contemporary transceiver, but once you get a feel for moving around through the various functions and settings, it quickly becomes intuitive.

The 45-page *User's Manual* is well organized and includes lots of illustrations. The instructions, for the most part, are clear and easy to follow. There are several instances where the translation is rough, but these typically do not lead to confusion.

The transmit audio of the AR-147 consistently solicited reports of "sharp" sounding audio. While most stations assured me that it was not objectionable, many indicated that they preferred the fuller sounding audio of my permanent station transceiver. I'd rate it as "communications quality."

Receive audio is very good. It's clear and plenty loud enough for even noisy environments.

One unusual characteristic is the behavior of the receive signal strength meter. Lab tests revealed that the difference in signal

strengths between a low level signal—resulting in a small deflection of the meter—and that of a signal indicating an S-9, was unusually small. Repeaters that are located at the fringe of my normal coverage area displayed S-9 plus meter readings, even though the level of noise in the receive signal confirmed their marginal accessibility.

As we observed with the AR-146, the new unit generates a considerable amount of heat during extended periods of high power operation. Keep this in mind when choosing mounting locations and take advantage of the lower power settings whenever possible.

Lab Results

Lab tests on the AR-147 reveal that this radio, as was the case with the AR-146, exhibits respectable performance (see Table 2).

Although the manufacturer's sensitivity specifications for this receiver and the one in the earlier unit are identical ($<0.18 \mu\text{V}$), the '146 we tested scored a hot $0.13 \mu\text{V}$ —smoking the other transceiver's in that roundup by a considerable margin. The $0.17 \mu\text{V}$ posted by the '147 is still very good, considerably above the running average for the single-band mobiles we're recently tested.

Two-tone third-order IMD dynamic range at 10-MHz offset, typically a good indicator of a receiver's intermod rejecting capabilities, is just slightly below the average for single-banders, but still very good at 89 dB. The IF rejection, though not quite as high as we measured on our '146, managed to maintain ADI's place at the top of the class for this specification.

One manufacturer's published specification that was not met is the transmitter's

spurious signal and harmonic suppression. ADI specified this at a surprisingly high 80 dB. The 70 dB measured by the lab is well above the FCC requirement (60 dB) and still very good when compared to the numbers typically generated by similar transceivers.

Overall Conclusion

The AR-147 provides a nice variety of high-end features and very respectable performance. It carries on the tradition of ADI's AR-146 as a good value in an economically priced mobile transceiver.

Manufacturer: Premier Communications, 480 Apollo St #E, Brea, CA 92821; 800-666-2654; fax 714-257-0600; premier@adi-radio.com; <http://www.adi-radio.com>. Manufacturer's suggested list price, \$300. Typical current street price, \$220.

Tower Jack Tower Tools

*Reviewed by Mark Wilson, KIRO
QST Editor*

If you've spent any time dismantling Rohn towers, you've probably had an experience like one I had taking down a Rohn 25 tower for a friend a few months ago. Everything is going great. You remove the six bolts holding the top section. The ground crew pulls the rope, you wiggle the loose section a little bit, and it pops off. Five minutes and you're ready to do the next one. It goes like this for a while, until you get to a section that just won't budge. You wiggle the section and try to push it up, but it just won't move. What now?

Typically, next I'd ask the ground crew to send up an automobile scissors jack and a couple of blocks of wood to pry the sections apart, along with some rope to safely tie all the pieces to the tower. But Tower Jack, of Mount Juliet, Tennessee, has a better idea.

The heavy duty version of the Tower Jack (Figure 1) weighs about five pounds and consists of two pieces of steel bar stock connected with a hinge bolt. The handle piece is 24 inches long, and the hinged piece is 12 inches. Both are notched to fit the round horizontal bracing on Rohn tower sections. This particular model is specified to fit Rohn 20, 25, 45 and 55 tower, but we only tried it with Rohn 25. There's a hole in the end of the handle for an optional Safety Strap to clip the Tower Jack to the tower or your climbing belt, or you can use your own safety rope.

Using the Tower Jack is easy (see Figure 2). To disassemble tower sections, orient the device with the handle up and place the bottom brace of the upper tower section

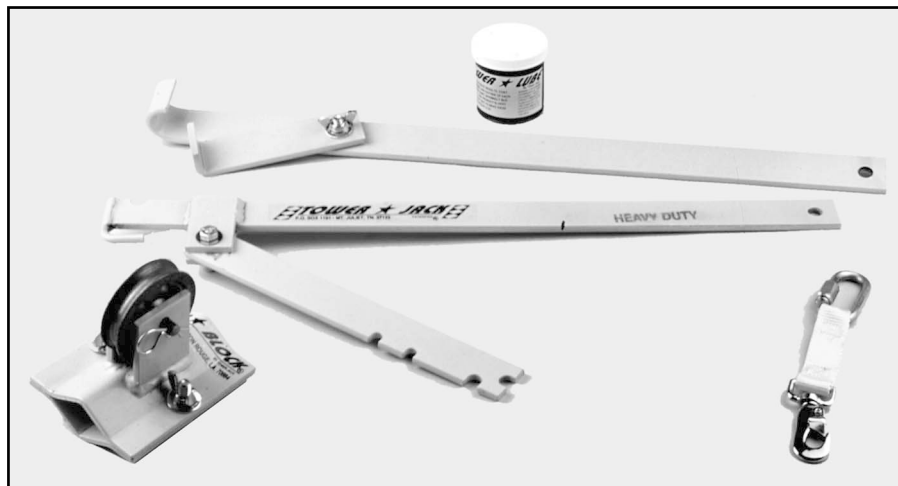


Figure 1—Tower Jack offers a wide variety of products for the assembly and disassembly of antenna tower sections. These include the Leg Aliner, the Tower Jack, the Tower Block and the Safety Strap. The container at the top of the picture contains their Tower Lube, for use on tower section mating surfaces during assembly.

in the notch at the end of the handle. Place the top brace of the lower tower section in one of the notches on the hinged piece. Pull down on the handle to lift the tower section.

For difficult sections, I found it best to lift at the corners. I'd work my way around the tower several times, lifting a little at each corner and gradually sliding the upper section up. With the 24-inch handle, you have a lot of leverage and it's possible to bend the bracing if you use too much force in the center of a rung.

You can also use the Tower Jack to assemble sections. In that case, the handle

attaches to the lower section with a hook. One of the notches in the hinged piece fits the brace on the upper section, and you pull down on the handle to slide the sections together.

Other Tower Jack Tools

Tower Jack offers several other tools designed to make tower work easier. Sometimes during assembly, the legs on tower sections just won't line up. This often happens because sections (even brand new ones) have been banged around in transit. Even a small misalignment in the tower legs can create a lot of frustration. Tower Jack



Figure 2—The Tower Jack provides the leverage needed to easily separate stubborn sections.



Figure 3—During tower assembly, you'll occasionally run into situations where some alignment adjustments are needed to get the third leg to insert. The Leg Aliner can provide the necessary force.

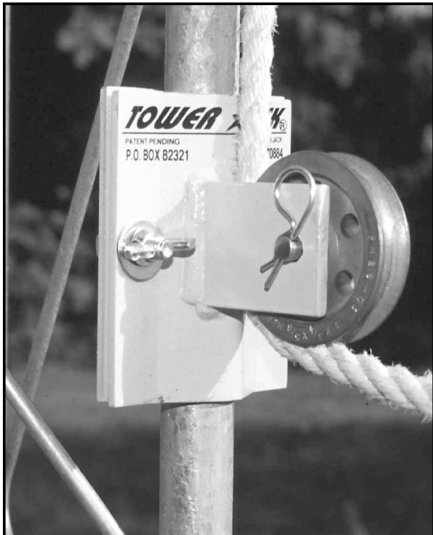


Figure 4—The Tower Block is used on the lifting line of your gin pole. This device allows your ground crew to remain safely outside of the “drop zone.”

offers the Leg Aliner (see Figure 3) to help with these stubborn cases. It's similar to the Tower Jack—just over two feet of steel bar—but this tool has a loop at one end that clamps to the offending tower leg. It gives you enough leverage to move legs that are slightly out of alignment, but it's not intended to straighten seriously bent sections.

We also tried the Tower Block (Figure 4), a pulley that attaches to one of the legs at the base of the tower. This block allows the ground crew to pull horizontally, rather than vertically, on the rope from the gin pole (the fixture used to lift tower sections during assembly). Pulling horizontally is easier on the arms, and it allows the ground crew to stand safely away from the “drop zone” beneath the tower. The Tower Block easily accommodates $\frac{3}{4}$ -inch rope. It

clamps to the tower leg with bolts and wing nuts. The pulley wheel is held in place with a clevis pin and hairpin cotter, making it very easy to thread the rope.

Tower Jack also offers Tower Lube to make section assembly and disassembly easier, a hard hat, and an electric utility winch for those really heavy jobs.

I found the Tower Jack tools to be well made and easy to use. The Tower Jack especially is a real time-saver when fooling with difficult sections.

Manufacturer: Tower Jack, PO Box 1191, Mt Juliet, TN 37122; tel 800-242-0130, 615-758-9233; <http://www.towerjack.com>. *Manufacturer's suggested amateur pricing:* Heavy Duty Tower Jack, \$59.50; Leg Aliner, \$33.95; Tower Block, \$56.50; Safety Strap, \$11.95.