Product Review Column from *QST* Magazine

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Ten-Tec Centaur Model 411 HF Linear Amplifier

AOR AR7030 Communications Receiver

Radio Shack Model 21-527 Digital SWR/Power Meter

Product Review

*Edited by **Rick Lindquist, N1RL**• Senior Assistant Technical Editor*

Ten-Tec Centaur Model 411 HF Linear Amplifier

By Rick Lindquist, N1RL
Senior Assistant Technical Editor

The Centaur represents Ten-Tec's attempt to go the extra mile in offering a low-end HF linear amplifier. The Centaur certainly is not the first "three-hole" 811A amplifier on the market, but the folks in Tennessee reckoned they could go a few steps beyond what was already out there, at the same time keeping the price in the same general ballpark. The result is an economical 600 W class amplifier that offers QSK as a standard feature—the only one in this price category to do so—plus hot-switching protection, pi-section input filters and other niceties.

Let's face it. Not everyone can handle the $2500 cost of a big-power amp—and not everyone needs that kind of power anyway. At this point in the sunspot cycle, though, some ops would just like a little leverage on the bands. Sometimes—just sometimes—the few hundred additional watts an amp like this can offer will make the difference between snagging that new one, making a sked or continuing an enjoyable ragchew under changing or less-than-optimal conditions. A little desktop amplifier like this can certainly fill a lot of gaps.

In typical Ten-Tec fashion, the Centaur is a fairly compact, straightforward box—nothing fancy. On the outside, it has vernier-driven **LOAD** and **TUNE** controls (calibrated with 0-10 markings on each knob's apron); a bandswitch (marked for 160, 80, 40, 20, 15 and 10 meters, but the amp shares positions for 30, 17 and 12 meters); two lighted multimeters (one reads either grid current or power output in watts; the other reads either plate voltage or plate current); a row of mini-toggle function switches; and a big rocker-style **POWER** switch to turn the unit on.

Inside the box (and visible through the ventilation holes in the top of the gray steel cabinet) are three Svetlana 811A tubes, a fairly husky transformer (1.5 kVA CCS and accounting for about half the weight of the amplifier), the tuning capacitor, and other components (see photo). The parallel 811As are operated in class AB_2 grounded-grid configuration with a nominal 550 mA of plate current and approximately 1700 V of plate voltage (at full load). The Centaur can operate satisfactorily from either 120 or 240 V ac input. A four-inch muffin-type fan moves 100 CFM of air across the three output tubes, so the amplifier runs quite cool (*much* cooler than my Collins 30L-1, which has four 811As in the output but a rather insubstantial-looking cooling fan). The excellent cooling should keep the 811As running for a long time, assuming you don't otherwise abuse them. The major tradeoff here is in fan noise (more on that subject later).

The Centaur is rated at 600 W output on SSB and CW on 80 through 15 meters, 500 W output on 160, 12 and 10 meters, and 400 W output on FM, RTTY or SSTV. (Ten-Tec says that by tuning up for full SSB or CW power then setting the carrier output at 150 W, the amp can be used for AM as well.) It takes the better part of the output of a typical transceiver to drive the Centaur to full output—90 W or so would do it in most cases, we found. We got the rated power on all bands except 17 meters, where it was much closer to—but not quite—500 W. While the Centaur manual advises keeping the plate current at or below 550 mA during tuneup, we found that the tubes drew up to 750 mA on some bands when the linear was tuned for rated output. Ten-Tec said this is normal. (My personal philosophy with an amplifier like this would be to run it at 450 to 500 W. There's precious little to be gained by pushing it to its absolute limits.)

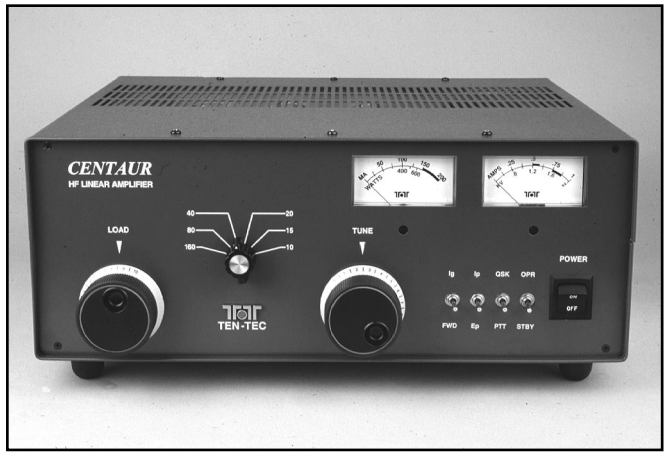
THE BOTTOM LINE

An economy-class "half-gallon" 811A linear amplifier with QSK standard. Works great, runs cool, but some ops might find the blower a little loud.

Setting up the Centaur is pretty easy. It comes from the factory wired for 120 V ac use, but if you've got 240 V available in the shack, it's quite simple (and probably advisable) to change two jumpers—accessible via a rear-panel "inspection plate"—plus a couple of fuses and the wall plug for 240-V operation.

As it comes from the factory, the Centaur does not operate on 12 or 10 meters (per FCC requirements). To add these bands, users first must send a photocopy of their Amateur Radio license to Ten-Tec requesting the free modification package. In return, they'll receive a small circuit board that installs via the "inspection plate" access panel. It takes about five minutes and involves no soldering.

The rear panel has SO-239 connectors



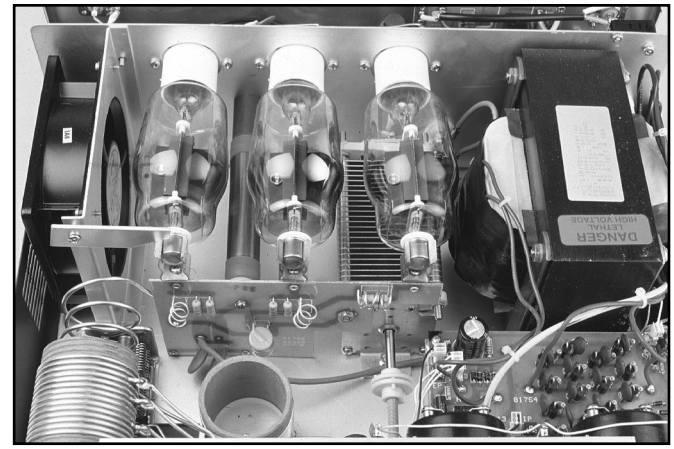


Table 1

Ten-Tec Centaur Model 411 HF Linear Amplifier, serial number 01A10087

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 160, 80, 40, 30,* 20, 17, and 15 meters; 12 meters and 10 meters by modification.	As specified (can be modified by licensed amateurs for operation on 12 and 10 meters).
Power output: 600 W on SSB and CW, 80-15 meters; 500 W on 160 and 10 meters. 350-400 W on RTTY or SSTV (depending on band).	As specified, except 500 W measured on 17 meters.
Duty cycle: SSB, continuous voice modulation, at rated PEP output; CW, 50% duty cycle, no time limit at rated PEP output (30 seconds maximum continuous key-down).	As specified.
Gain: Not specified.	Approximately 8 dB, typical.
Drive power required for full output: 90-100 W, typical.	As specified.
Spurious signal and harmonic suppression: Meets or exceeds FCC requirements.	≥48 dB.
Intermodulation distortion (IMD): Not specified.	See Figure 1.
Power supply requirement: 120 V ac at 12 A; 240 V ac at 6 A.	As specified.
Size (HWD): 6×15.5×13 inches; weight: 40 lb.	

*The FCC-specified maximum legal output on the 30-meter band for US amateurs is 200 W PEP.

Expanded Product Review Report Available

The ARRL Lab offers an expanded test result report on the Ten-Tec Centaur Model 411 HF Linear Amplifier that gives in-depth, detailed technical data on the amplifier's performance, outlines our test methods and helps you to interpret the numbers. This report includes full-power spectral purity charts for each band and a chart showing how it stacks up against similar, previously reviewed units.

Reports are $7.50 for ARRL members and $12.50 for nonmembers, postpaid. Request the Ten-Tec Centaur Model 411 Test Result Report from the ARRL Technical Department, 225 Main St, Newington, CT 06111 (personal checks accepted). For credit card orders only, call 860-594-0278.

for the RF input and output. The rear panel also has an **ALC** input jack and an **ALC CONTROL**. If you plan to take advantage of the QSK (for some users, this will be the main reason for buying this amp), you need to wire your keying line through the Centaur. This is accessible through RCA jacks on the rear of the amplifier. If you have a late-model Ten-Tec transceiver with **TX OUT** and **TX EN** jacks (such as an Omni VI), connecting these to the **KEY IN** and **KEY OUT** lines, respectively, takes care of keying the transceiver for other modes. For other transceivers, there's a **PTT/VOX** jack. There's a wing-nut connection for ground.

The first thing you'll notice when you push on the **POWER** switch is that the whole box will shudder a bit. This is disconcerting, but normal. The next thing you'll certainly notice is the rapidly increasing decibel level of the cooling fan as it accelerates to warp speed. As noted, Ten-Tec moves *a lot* of air through this amp, and it makes a bit of noise in the process. The high blower noise level was the only major complaint about this otherwise well-thought-out and well-built economy amplifier. We checked sound levels of some other amps and found the Centaur to be noisier than even some higher-power units. Ten-Tec acknowledges that the fan is loud, but a spokesman said it was a design decision to incorporate lots of air flow. Ten-Tec says it's been unable to come up with a quieter means of doing so that's within economic reason and does not compromise tube life and component longevity. Even so, many ops would probably be willing to sacrifice some tube life for a quieter-running amp. After all, new 811As are relatively inexpensive.

The mini-toggle switch next to the **POWER** switch selects **STBY** (standby) or **OPR** (operate). By following the directions in the *Operator's Manual*, any operator who's at all familiar with how a tube linear like this tunes and works will pretty quickly get the hang of the tuning procedure. If this is your first amp, just follow Ten-Tec's clear instructions in the *Operator's Manual*. The main thing (as Ten-Tec warns) is to avoid overdriving the 811As. This is one excellent reason for including separate meters to simultaneously read the 811A grid current and plate current. By the way, the **LOAD** and **TUNE** control knobs had rubberized grips and spinner holes. Their vernier action was silky smooth.

Another of the front-panel toggle switches lets you select **QSK** or **PTT** operation. For CW, the QSK was super. Other ops—including those who take pride in having a critical ear for keying—said it sounded great. For a CW hand like me, not having to shut off my transceiver's full-break-in when running the amp was a gigantic plus. On SSB, the amplifier performed well too. No splatter or distortion was noted by other stations, and our Lab tests indicated good IMD performance (see Figure 1).

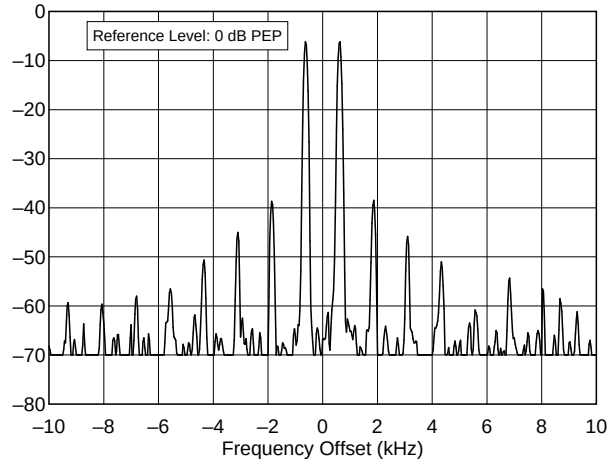


Figure 1—The Ten-Tec Centaur Model 411 spectral display during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 39 dB below PEP output, and fifth-order products are approximately 45 dB down. The amplifier was being operated at 600 W output at 14.02 MHz.

The built-in wattmeter is handy. The one in our review unit measured to within approximately 10%, worst-case. It was most accurate on 40 meters, where our Lab wattmeter and the Centaur's wattmeter agreed. On other bands, it read up to 10% low.

Ten-Tec did quite a nice job on the *Operator's Manual*. It's complete and to the point. There's a tuning chart to help you get in the ballpark while tuning up, plus a chart where you can record actual settings for each band; a troubleshooting chapter; detailed descriptions of most individual circuit boards—right down to pictures and PC trace templates; and schematic diagrams of everything. There was no parts list detailing the values of components called out on the schematics, however. In-

structions are step-by-step. My favorite line of the manual came in Chapter 1—Installation: "If any of your home entertainment electronic devices have RF leaks, the Centaur will find them."

Ten-Tec has done a fine job of designing and putting together the Centaur, especially when you consider its price tag. At the same time, the amp's very efficient cooling system comes at the cost of some noise. The price and features are certainly right, however, so if you can manage this shortcoming, the Centaur could be your next—or your first—linear.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; tel 423-453-7172; fax 423-428-4483. Manufacturer's suggested retail price, $750.

AOR AR7030 Communications Receiver

Reviewed by Paul Danzer, N1II
Assistant Technical Editor

Sounds good! That was my first impression when I turned on this little black box with its Euro-styled front panel and a few—very few—knobs and push buttons. In fact, the radio's exterior styling really distinguishes it from the traditional, utilitarian approach of most general-coverage sets. It also has a remote-control box, similar to ones that commonly come with VCRs and TV sets, something that sets it apart from its peers (and makes it look for all the world like a satellite TV receiver). This is definitely not ham gear!

The overall effect of the AR7030—with its swooping display window; black, brushed-finish front panel; textured-finish case; and flush, hex-head hardware—is striking. It's compact, quite handsome and unique, but its real beauty is more than skin deep. The AR7030 performs very well too, and lives up to its designation as a "high dynamic range general-coverage receiver." Our relatively early production unit AR7030 did not *quite* meet AOR's dynamic range specification of 100 dB (measured at 12.7 MHz), but it came quite close at 14.2 MHz (see Table 2).

To put it into a ham's perspective, our original AR7030's dynamic range performance was a bit better than that of the Yaesu FT-1000MP (see "Product Review," *QST*, Apr 1996) but not quite as good as the ICOM IC-756 (see "Product Review," *QST*, May 1997). That certainly puts it in good company.

I may have set a new record. Within three minutes I had pushed enough controls to have a totally unintelligible display on the front panel, no output from the speaker and no clue as to what to do. Okay, when in doubt, read the manual—and there on page 2 is a paragraph with a bold-faced title: "**Overview—read *THIS* if nothing else**." Then, three paragraphs down, is the sentence: "If you really mess up the settings, a LOAD DEFAULT facility has been included so that you can return the set to its out-of-box condition (except for memory contents)." Push one button, turn one knob, push a second button (all well marked) and we are back in business. I wonder how they knew I would do that?

What's So Special about this Receiver?

The AR7030 is the result of a collaboration between AOR and well-known UK designer John Thorpe. The AR7030 is built in the UK, and it has just about every feature you want—IF gain, RF gain, BFO, passband tuning, treble and bass controls, and memory storage of frequency, mode and all settings (100 memories!). You can save (and load) up to three receiver setups in the special setup memories (A, B or C).

Want to listen to music on a shortwave broadcast band? Select AM or synchronous AM, set the tone controls, memorize a few frequencies and you are ready to go! SSB your choice? Preset the filter bandwidth to 2.0 kHz, the mode to USB or LSB and memorize the settings.

Want to change from one preset to another or start over with a new mode, frequency, gain and filter? You can use either the front panel controls or a remote control unit.

Normally, I would not open up a review unit. We usually leave that to Mike Gruber, W1DG, and the other folks in the ARRL Lab. But in this case, with so much crammed into one small box—and the use of hex-head screws—it was a challenge I couldn't resist. And, inside, it is *beautiful!* A mixture of DIPs and surface-mount components sat on a shiny board with readable component labels. Looking for test point TP4? The label is fully visible, and not under a nearby component. Even the thickness of the metal case was impressive.

BOTTOM LINE

This is a slick, attractive, quality-made receiver with practical and aesthetic appeal—and with a price tag to match. It's a terrific performer, but the use of menus instead of dedicated controls might confound some users.

The AR7030 features dual conversion, with IFs at 45 MHz and 455 kHz. AOR claims the IF filters are "self-aligned by the receiver, using advanced microprocessor control." According to AOR, the displayed filter bandwidth actually represents the bandwidth measured by the receiver!

As you would expect from a modern receiver, two VFOs are included, A and B (which AOR calls Active and Background, respectively). Each VFO has an associated memory of mode, volume, tone, filter bandwidth, passband tuning, BFO frequency, IF gain, RF gain or attenuation, AGC, squelch, scan delay time, scan mode and, of course, frequency. These settings, depending on the mode selected, can be stored in each of the available 100 memory locations.

The front panel has a comfortably weighted tuning knob with adjacent **FAST** and **MODE** controls. The tuning knob has a nice quality feel to it, and the faster you spin, the greater the tuning rate. A **FAST** button allows you to quickly move the frequency to anywhere in the "dc" to 32-MHz range. The AR7030 tunes in 2.7-Hz steps, but you won't hear any chuffing in this set. Two **MODE** push buttons cycle through the available modes—AM, synchronous AM, NBFM, data, CW, LSB and USB.

One knob and four push buttons under the display are keyed to the display. Their use depends on the menu settings. They are truly multifunction controls, and this where this receiver gets interesting—or confusing, depending on your point of view.

The AR7030 requires 15 V dc, which, in the case of our unit, was supplied by the external ac adapter that came with the radio. AOR says the radio will operate using a power source from 12 to 15 V dc but "with degraded performance at 12 V."

Table 2

AOR AR7030 Communications Receiver, serial number 100344

Manufacturer's Specifications	*Measured in ARRL Lab*
Frequency coverage: 0-32 MHz.	As specified, with usable sensitivity to <20 kHz.
Modes of operation: AM (envelope and synchronous),USB, LSB, CW, DATA, and NBFM.	As specified.
Power requirements: 15 V dc, 1 A (max).	As specified.
Size (HWD): 3.1×9.5×7.6 inches; weight, 4.9 lb.	
SSB sensitivity, 10 dB (S+N)/N, 2.2-kHz filter: 20 kHz, preamp off, 1.9 μV, preamp on, 1.4 μV; 100 kHz, preamp off, 0.73 μV, preamp on, 0.34 μV; 500 kHz, preamp off, 0.5 μV, preamp on, 0.18 μV; 1.0 MHz, preamp off, 0.52 μV, preamp on, 0.19 μV; 5 MHz, preamp off, 0.5 μV, preamp on, 0.19 μV; 14 MHz, preamp off, 0.58 μV, preamp on, 0.23 μV; 28 MHz, preamp off, 0.6 μV, preamp on, 0.23 μV.	CW, minimum discernible signal (MDS), 2.0-kHz IF filter: 180 kHz, preamp off, –122 dBm, preamp on, –131 dBm; 500 kHz, preamp off, –123 dBm, preamp on, –133 dBm; 1.0 MHz, preamp off, –123 dBm, preamp on, –132 dBm; 3.5 MHz, preamp off, –123 dBm, preamp on, –131 dBm; 14 MHz, preamp off, –121dBm, preamp on, –129 dBm;
AM sensitivity, 10 dB (S+N)/N, 70% modulation, 5.5-kHz IF filter: 500 kHz, preamp off, 0.85 μV, preamp on, 0.33 μV; 1.0 MHz, preamp off, 0.88 μV, preamp on, 0.36 μV; 5 MHz, preamp off, 0.86 μV, preamp on, 0.35 μV; 14 MHz, preamp off, 1.0 μV, preamp on, 0.42 μV; 28 MHz, preamp off, 1.0 μV, preamp on, 0.40 μV;	AM sensitivity, 5.5-kHz IF filter, 30% modulation: 3.8 MHz, preamp off, 1.84 μV, preamp on, 0.74 μV; 1.0 MHz, preamp off, 1.84 μV, preamp on, 0.75 μV. 70% modulation: 1.0 MHz, preamp off, 0.78 μV, preamp on, 0.32 μV; 3.8 MHz, preamp off, 0.78 μV, preamp on, 0.32 μV.
FM sensitivity, 12-dB SINAD, 1.5-kHz deviation, 10-kHz IF filter: 28 MHz, preamp off, 1.2 μV, preamp on, 0.48 μV.	FM, 12-dB SINAD, 3-kHz deviation, 9.5-kHz IF filter: 29 MHz, preamp off, 1.22 μV, preamp on, 0.42 μV.
Blocking dynamic range: USB mode, 12.7 MHz, 2.2-kHz IF filter, 9.3-MHz spacing, preamp off, 137 dB.	CW mode, 14 MHz, 100-kHz spacing, preamp off,138 dB, preamp on, 135 dB; 20-kHz spacing, preamp off, 126 dB*, preamp on, 121 dB.*
Two-tone, third-order IMD dynamic range: USB mode, 2.2-kHz IF filter, 10 to 20-kHz spacing, preamp off, 100 dB, preamp on, approximately 98 dB.	CW mode dynamic range, 2.0-kHz IF filter: 1.0 MHz, preamp off, 90 dB, preamp on, 96 dB; 3.5 MHz, preamp off, 94 dB, preamp on, 98 dB; 14.0 MHz, preamp off, 97 dB, preamp on, 97 dB.
Third-order intercept: Preamp off, +27 dBm, preamp on, approximately +17 dBm.	1.0 MHz, preamp off, +13.9 dBm, preamp on, +12.5 dBm; 3.5 MHz, preamp off, +19.9 dBm, preamp on, +18.7 dBm; 14.0 MHz, preamp off, +28.1 dBm; preamp on, +22.0 dBm.†
Second-order intercept point: Preamp off, +85 dBm.	Preamp off, +74 dBm; preamp on, +48 dBm.
FM adjacent channel selectivity: Not specified.	29 MHz, preamp off, 87 dB; preamp on, 88 dB.
FM two-tone third-order dynamic range: Not specified.	29 MHz, preamp off, 87 dB*; preamp on, 88 dB.*
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW, 2.0-kHz filter, 57-1934 Hz (1877 Hz); USB, 5.5-kHz filter, 346-5826 Hz (5480 Hz); LSB, 5.5-kHz filter, 101-5581 Hz (5480 Hz); USB, 2.0-kHz filter, 179-2469 Hz (2290 Hz); LSB, 2.0-kHz filter, 217-2517 Hz (2300 Hz); AM, 5.5-kHz filter, 56-2805 Hz (2749 Hz); AM, 6.5-kHz filter, 61-4000 Hz (3939 Hz); AM, 9.5-kHz filter, 57-4400 Hz (4343 Hz).
First IF rejection: 85 dB or better.	Preamp off, 88 dB; preamp on, 100 dB.
First IF image rejection: 85 dB or better.	Preamp off, 81 dB; preamp on, 75 dB.
Squelch sensitivity Not specified.	At threshold, FM, 29 MHz, preamp off, 0.4 μV, preamp on, 0.08 μV.
S-meter sensitivity: Not specified.	14 MHz, S9, preamp off, 94 μV; preamp on, 29 μV.
Audio output: 2.2 W into 8 Ω.	2.7 W at approx 10% THD into an 8-Ω load.

NOTE: Except as noted, all dynamic-range measurements were taken using the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise-limited at value shown.

†Third-order intercept point was determined using S5 reference.

Digital Displays—The Good and the Bad

The front panel is attractive and stylish, but at a cost of a more comprehensive display of information. The AR7030 sports a green-backlighted LCD display that can fit up to 48 characters—numbers, letters, S meter bar graph and clock time—at any one time, so it's a bit limited in what it can show at any given time. The individual characters are a bit coarse (ie, not as bold) compared to similar displays on transceivers we've seen. The front panel has an effective viewing angle of at least 45° from head on, in any direction. In good lighting this angle increases.

You can program this receiver to do whatever you want, and it will memorize your favorite settings. However, if you forget your settings, you must step through a menu to find out what you set a short time ago, yesterday or last year.

Two buttons on the left-hand top corner of the radio—one with a light and dark dot and the other labeled **MENU**—select two banks of functions. You use the "double-dot" push button to shut off the receiver. The labels of three buttons in the second column under the display window are **FILTER, RF-IF** and **MEMORY**. In combination with the "General" button (labeled simply *****) and a small rotary knob (which AOR calls a "spin-wheel"), all receiver functions are available from the front panel, assuming you follow the menu.

I found many functions to be more easily controlled by the remote control unit. Frequency, memory selection, recall and storage, mode and filter selection only require a few pushes of the remote control's buttons. In fact, direct frequency entry is possible *only* via the remote control box. Volume can be controlled either by a simple rotary knob on the receiver front panel or from the remote-control box (I happen to like rotary volume controls).

How easy is control through a menu system? Well, it's a bit like using some of today's more compact radios and H-Ts, where multifunction controls predominate. It's not always intuitive, but the manual is

pretty helpful. Sometimes I found it easy, but occasionally I got lost and had to start the entire process over. After a few hours of using the radio, many controls become second nature.

One thing that made the menu system a bit more confusing was the natural tendency to try to make adjustments based on the printed front-panel labels. That's because the menus can change a button's normal function—something that was not readily apparent, even from reading the manual. For example, it was not immediately obvious that you use the **RF-IF** and **MEMORY** buttons to turn on the receiver's built-in preamp or to kick in up to 40 dB of attenuation. The trick is to pay attention to the menu labels on the display window. These tell you what the buttons and controls are actually used for within a given menu.

Within the confines of this menu system, you can recall each setting, but not all of them at the same time. Often, it took many pushes and turns before I found my current settings, and then had to push the menu button one more time just to get back to using the receiver!

Fingers and Eyeballs

If you plan to spend a lot of time using a receiver, the feel of the controls and the clarity of the display are very important. Almost all receivers (and transceivers) these days are built too close to the table for my fingers, but a fold-down bail is mounted under the AR7030. Many users will find the bail very helpful to raise the controls to a more comfortable level and to angle the display for better viewing.

Since I found it easier to control many functions from the remote control unit, it was a strange feeling to take my hand off the front panel and pick up the remote unit. I'm not sure how quickly you can get used to switching between ham-knob and "VCR" modes of control. Maybe if you watch a lot of TV, you'll also feel at home with the AR7030.

AOR does allow for using the remote control box in an unconventional way. There is a sensor at both the front and the back of the receiver, and you can stand to the side, with the front panel shielded, and bounce the remote signal off the back wall of the operating area into the rear panel sensor!

Ins and Outs

The front panel has a 3.5-mm stereo audio jack, a very nice touch. Audio for the headphones and auxiliary output is provided in two channels, although the AR7030 does not provide stereo output. Since most inexpensive headphones these days are wired for stereo—to work with portable CD-players and tape decks—this means you will not need one of those pesky stereo-to-mono adapters to use an ordinary set of headphones.

The rear panel has a selection switch for either a 50-Ω antenna connection or a random-length wire. An RS-232 interface is supplied. AOR's *Data-Master* software for *Windows* and *Windows 95* is available as an option. There's also a contrast knob on the rear panel, although you probably won't need it. The display is a black-on-green LCD panel, but full contrast seemed to give the best readability.

How Does It Sound and How Does It Work?

It sounds good! The Lab measurements tell the story in numbers, but the audio was clean and full. SWLing was a pleasure, and the 3½-inch internal speaker was remarkably pleasant. The AR7030 lets you boost or cut the treble and bass to shape the audio for your listening taste. (When I plugged in the external speaker I usually use with my vintage ICOM receiver, it didn't sound nearly as good as the built-in speaker.) Sideband signals sounded crisp. I did not use it to listen during any contests, but the standard "tune 20 SSB on a Sunday morning" test was impressive. It worked fine for listening to the standard AM broadcast band, too—even at night (perhaps especially at night).

The AR7030's synchronous AM detection helps to minimize problems with selective fading. Not only that, you can pick individual sidebands on AM signals and even switch in different filters while in synchronous mode to help dodge interference. Qualitatively, there was a little less noise apparent on synchronous AM detection than on ordinary AM detection, but the audio quality was the same. Tuning was a snap. Just get close, press the button for **Snc** and the AR7030 will automatically tune in the signal. Turn the tuning dial to look elsewhere, and the radio will automatically swap over to conventional AM mode.

The radio is not as sensitive as most of the ham transceivers we've looked at lately, but engaging the preamp gives you about a 10-dB boost. If you're planning to encounter very strong signals, the AGC is a must. By the way, the radio offers four AGC settings—fast, medium, slow and off.

Our AR7030 had no noise blanker, but AOR has just come out with its optional NB7030 "enhanced multi-function audio notch and RF noise blanker" board. (The NB7030 includes a new microprocessor chip for the radio that also provides 400 memories and memory-naming, among other features.)

You can set the tuning step for changing the frequency using the remote control. Step tuning worked fine on the AM broadcast band (set to 10-kHz steps), but after pushing the button a few times, we noticed that the frequency on the display would be off by 10 Hz (ie, 1079.99 instead of 1080 kHz).

The AR7030 can scan between its two VFOs (which AOR calls dual-VFO operation), and you can set the minimum time that each VFO is monitored before it switches to the other VFO (from 0.5 to 30 seconds). You can also scan memories.

We did not purchase any optional filters for the AR7030, but the receiver can accommodate two additional IF filters in the 455 kHz IF. AOR says that, "within reason," any 455-kHz filter can be used, but the PC board is drilled to accept Murata filters and Collins mechanical filters.

These days we expect receivers to be stable. This receiver, which incorporates a temperature-compensating crystal oscillator (TCXO), claims stability of better than 1 part per million from 10° to 40° C. My test was very practical: when left in my basement shack for a few days, will the AR7030 continue to copy weather RTTY without being touched? I often leave a receiver on the maritime information FEC broadcast on 518 kHz (in addition to the 8 MHz weather broadcasts). This receiver was rock solid for more than three days—the only reason for the three-day limit was that I needed to recover the use of the computer for other tasks!

Operating Manual

No discussion of the AR7030 would be complete without a few words about the 37-page *Operating Manual*. It's thorough, and it's thoroughly British, complete with a little wry humor from time to time. For example, it suggests running through the filter calibration procedure if "you have just got bored with listening to your radio." At another point, it asserts that the main tuning dial "likes to be used…give it a few turns once in a while."

Charts early on in the *Operating Manual* reveal the mysteries of the menu structure. There's also a handy quick reference guide that covers the essentials of operating the AR7030. Another quick reference guide explains remote-control box basics. There's a block diagram and four pages of specifications (many more than the typical transceiver), but no schematic. The manual frequently includes sample display windows to guide you through the intricacies of operation. An index would have made the manual more useful.

Is This Receiver for You?

The minimal controls combined with the limited number of items on the display didn't appeal to me, but others who used the AR7030 had fewer problems with this arrangement. For many functions, using the remote control was much less awkward. It's all a matter of style, and we hams often feel more at home with lots of dials and buttons. If you're already acclimated to using a remote control "clicker" for your TV and VCR, the AR7030 will likely be a breeze to operate. Many discriminating listeners would find this a great set to have in their listening post or even in their den, and it's a superb performer.

Thanks to Rick Lindquist, N1RL; and

Mike Tracy, KC1SX, and Mike Gruber, W1DG, of the ARRL Lab, for their help in conducting this product review.

Manufacturer: AOR Manufacturing Ltd, 4E East Mill, Bridgefoot, Belper, Derbyshire DE56 2UA, UK; tel +44 1773 880788; fax +44 1773 880780; e-mail **info@aor.co.uk**; WWW **http://www.demon.co.uk/aor/**. Manufacturer's suggested retail price: \$1400. NB7030 audio notch and RF noise blanker board, \$315; SM7030 service kit, \$90; FPU-7030 enhanced features CPU, \$110.

Radio Shack Model 21-527 Digital SWR/Power Meter

Reviewed by Steve Ford, WB8IMY
Managing Editor

Someone once said that SWR meters are the inventions of the Devil because they cause so much suffering. There is a lot of truth in that statement. Many hams grieve needlessly over antenna systems that register "horrible" 1.8:1 SWRs. Their diabolical meters compel them to spend *hours* tweaking and re-tweaking in desperate attempts to reach Nirvana—the "perfect" 1:1 SWR. And for what?

But bedeviling aspects aside, SWR meters *do* serve useful purposes. Most modern transceivers won't tolerate more than a 2:1 SWR before they begin reducing output, so it pays to have some knowledge of your SWR conditions. In addition, your SWR meter often provides the first indication of trouble in your antenna system. If you leave it in the line at all times, you can watch for sudden variations that might signal a broken wire, a corroded connector, an arcing antenna tuner and so on. And if your SWR meter includes a wattmeter function, you can also use it to keep an eye on your radio's output level.

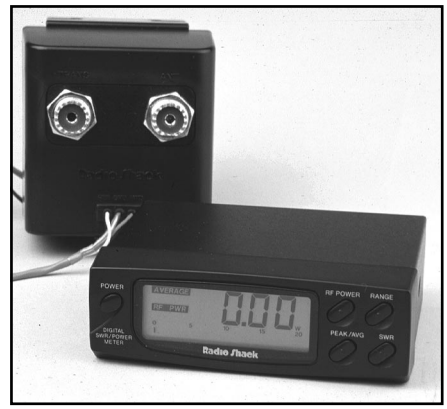
In recent years, the *digital* SWR meter has been encroaching on a market dominated by analog meters. Digital meters tend to be expensive, however, which limits their appeal. Radio Shack hopes to win the hearts of hams with a new approach—an *economical* model known as the model 21-527. Can they succeed?

Features

The 21-527 lets you measure SWR and power from 1.8 to 30 MHz in ranges from 1 W to 2 kW. You can select power ranges manually (a button on the display unit steps through the 20, 200, and 2000-W scales), or leave it to the meter's autoranging function. I preferred the convenience of autoranging.

The SWR readings appear on a compact, easy-to-read, backlighted LCD display. If the forward power input to the meter is less than 0.5 W, it cannot calculate the SWR and simply displays **Lo**. If the SWR is too high, it displays **InF**. You can also select a peak or average-power display (more on that later).

The 21-527 includes a remote sensor unit, which lets you sample the RF at one location and view the results at another. The sensor connects to the display unit via a four-foot-long, three-wire cable and a mini-stereo plug. (The manual states that you can use a cable of greater length, but it doesn't mention a *maximum* length.)



A 12-V dc power cube is included with the meter. For this review I simply used my station power supply. There are only so many ac outlets to go around!

On the Air

The 21-527 was installed in minutes. In my station, the only issue was finding a place to hide the remote sensor, which takes up a bit more space than the digital control box. The remote sensor has a mounting bracket. The control box has threaded holes in each side that appear to be designed to accommodate a mounting bracket, but none was supplied.

I subjected the meter to power levels from about 0.5 W to 600 W. Readings in the average power-setting—the power-up default—were confusing. Unless it was reading a steady carrier, the display flashed a bewildering cascade of digits that never seem to settle down. As a result, I used it in the peak mode at all times. Tests in the ARRL Lab indicated, however, that the meter was not really providing a true PEP reading, but something that was more than average power but less than PEP. To put it in perspective, however, the meter was about as accurate on PEP readings as many of the wattmeters we looked at in a comparative review of SWR/wattmeters a few years ago (see "Product Review," *QST*, Feb 1991). The auxiliary bar graph at the bottom of the display is a nice touch. It augments the digital readout by providing a relative indication of power or SWR—depending on the mode you've selected.

SWR readings were a snap. My only complaint—and this applies to many other digital SWR meters—was that the display was slow to adjust to abrupt changes. I use a venerable Johnson Matchbox antenna tuner with a dipole that's center fed with 450-Ω ladder line. With my analog meter it's easy to see the sharp SWR dips as I adjust the Matchbox. If you rely solely on the digital readout of the Radio Shack 21-527, it's possible to miss these tuning points because of the display's slow response. On the 21-527, however, you can use the auxiliary bar graph across the bottom of the display instead of the digital readout to see the SWR "dip." Of course, if you are using a resonant antenna system, or an automatic antenna tuner, this isn't an issue.

We spot-checked the accuracy of the wattmeter in the ARRL Lab, using it to measure power from 10 W to 1500 W on 80, 20 and 10 meters. For the most part, measurements made using the Model 21-527 were within 10% (in most cases, *well* within 10%). Things started to veer out a bit above power levels of 1000 W or so on 28 MHz, but the meter still was only approdimately 10% off at 1500 W. That's quite respectable for a meter that costs around \$60.

Conclusion

The Radio Shack 21-527 is a fine value if you want the convenience of a versatile digital SWR/power meter at a reasonable price. But you'll have to hurry to get one—Radio Shack is closing out this product. The ±10% full-scale accuracy is more than adequate for most amateur applications. It certainly would be suitable for mobile use. The ability of the 21-527 to provide readings from QRP to QRO power levels is a big plus not found on many HF SWR meters. The stylish 21-527 design and the remote sensor are icing on the cake.

BOTTOM LINE

An economically priced digital SWR/wattmeter with good accuracy and good looks. It includes a remote sensor, and it's entirely adequate for typical, non-critical ham use.

A special thanks to ARRL Educational Programs Coordinator Glenn Swanson, KB1GW, for his contribution to this review.

Manufacturer: Tandy Corporation, 1900 One Tandy Center, Ft Worth, TX 76102; tel 817-390-3700. Manufacturer's suggested retail price, Model 21-527, \$60. QST