Product Review Column from *QST* Magazine

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Advanced Radio Devices 230A MF/HF Linear Amplifier

Uniden President HR2510 10-Meter Transceiver

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Assistant Technical Editor

Uniden President HR2510 10-Meter Transceiver

Reviewed by Kirk Kleinschmidt, NTØZ

Reasons to buy the Uniden® President™ HR2510 are many. It's a compact, full-function transceiver that features digitally synthesized frequency control, RIT, noise blanking and all-mode operation. The price is right (around $270), and it even looks good! With all of its positive attributes you might think it'll do anything, anywhere. It won't—but as a 10-meter mobile rig, it's a value that's difficult to top.

My '2510 experience began as soon as I got a glimpse of the box. The radio is pictured on all six panels! Superimposed on the high-quality color photographs are a lot of numbers and their associated descriptions of the rig's controls and functions. I've never seen a rig with such an attractive carton! It's not too difficult to see that the '2510 is an outgrowth of Uniden's experience in building and marketing CB radios—this radio even has the telltale public address mode. The HR2510 is one of several recently introduced 10-meter mobile rigs aimed at exploiting the fantastic band conditions associated with the rise of solar cycle 22, and the increase in 10-meter SSB activity since US Novices and Technicians gained voice privileges on the band a couple of years ago.

The '2510 comes with a mobile mounting bracket, a hand-held dynamic microphone with up/down tuning buttons, a power cord, accessory plugs and the operator's manual. The 22-page manual is well written, but not overly informative. The controls, connections and features of the rig are explained well enough with text and photos, but there's no schematic, and no technical information other than diagrams of the microphone and accessory connectors. (Heck, even my old CB rig came with a schematic!)

Controls

The rig's front panel contains a bunch of controls—some 20 in all—many of which perform multiple functions. Although the '2510 is relatively small, the front-panel controls are not crowded. You're not in danger of pushing two buttons at once, as you are with many VHF mobile rigs.

Here's a rundown of the 2510's front panel: mode switch (USB, LSB, AM, CW, and FM are available); SWR/CAL; MIC GAIN; TX switch; METER switch (S/RF, modulation and SWR indications can be selected); PA (public address) switch, Noise Blanker switch; display DIM switch (backlight brightness); SCAN switch; SPAN switch (selects VFO tuning rate); CHANNEL up/down, BAND switch (selects one of four portions of the 10-meter band); Frequency LOCK switch; VFO; SQUELCH; on/off/AF gain; and the BEEP switch (discussed later). Also on the front panel are the mic connector and the multifunction meter/frequency display (LCD).

In contrast to the front panel, the rear panel is sparsely populated, with only an SO-239 antenna connector, power connector, heat sink and a multipin accessory connector.

The accessory plug is a 9-pin Molex type, which I found to be a real bother. Two of this connector's pins must be jumpered to enable the internal speaker. Connections to an external speaker, external public-address speaker and CW key are made here as well.

Operation

The HR2510 is easy to get on the air. It's about as close to "plug-and-play" as they come. Simply plug in the microphone and headphones (or jumper the rear-panel accessory jack to enable the internal speaker), attach the antenna and a suitable power supply, and you're ready to go. There's nothing to tune up (there's no mic gain adjustment other than a button that, when pressed, cuts the gain way down).

If you're itching to get the rig on the air, it's easy to figure out the front-panel controls, tune in a station or find a clear spot, and let 'er rip. The manual does, however, warn you to make sure the SWR at the antenna connector is below 2:1, or transmitter damage could result. How sensitive is the rig to high SWR? We can't say, but the rig came through unscathed after I accidentally keyed the transmitter without connecting an antenna.

Tuning the '2510 is accomplished by rotating the VFO knob, mounted near the middle of the rig's front panel. The VFO tuning steps are selected by repetitively pushing the SPAN button. Available steps are 10 kHz, 1 kHz and 100 Hz. The small VFO knob (it's only about an 1½-inch in diameter), and the fact that it goes "click-click-click" (because it is a detented control), makes the experience of tuning the rig seem rather "unradio-like." If you're used to a smooth-spinning tuning control, you'll have to get used to this one. It's a lot like tuning a 2-meter mobile rig or setting the rotary switch on a digital voltmeter. The "deedle-eedle-eedle" effect resulting from the rather large 100-Hz tuning increments present as you tune across the

Table 1

Uniden HR2510 10-Meter Transceiver, Serial no. 83000616

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: 28.0000 to 29.6999 MHz	As specified.
Modes of operation: USB, LSB, CW, FM, AM.	As specified.
Frequency display: backlit LCD.	6-digit LCD on orange background.
Frequency resolution: not specified.	100 Hz.
Power requirement: 13.8 V dc, 5 A max on transmit.	Minimum audio output (receive), 380 mA; full audio output, 630 mA; CW (transmit), 5 A.
Frequency accuracy: not specified.	Displayed transmit frequency, 28.0200 MHz; measured frequency, 28.0197 MHz.
Transmitter	*Transmitter Dynamic Testing*
Transmitter output power: CW, 25 W nominal; SSB, 25 W PEP; AM/FM, 10 W nominal.	CW, 25 W; SSB, 24 W PEP; AM/FM, 10 W.
Spurious signal and harmonic suppression: −50 dBc nominal, all modes	See Fig 1.
Carrier suppression: −55 dBc.	−66 dBc.
Unwanted sideband suppression: −45 dBc.	−64 dBc.
Third-order intermodulation distortion products: not specified	See Fig 2.
CW keying characteristics: not specified.	See Fig 3.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity (for 10 dB (S+N)/N): AM, 0.5 μV nominal; CW/USB/LSB, 0.25 μV.	Minimum discernible signal (noise floor); CW/SSB, −131.5 dBm; AM, −127.5 dBm.
FM sensitivity: 0.5 μV for 20 dB (S+N)/N	−115 dBm for 20-dB (S+N)/N; −111.5 dBm for 20-dB SINAD.
Receiver dynamic range: not specified.	Blocking dynamic range: 94 dB at 25-kHz spacing; 95 dB at 50-kHz spacing. Third-order IMD dynamic range: 69.5 dB Third-order input intercept: −27.25 dBm.
S-meter sensitivity (μV for S9 reading):	92 μV at 28.5 MHz.
Squelch sensitivity: not specified.	Min, 0.97 μV; max, 1500 μV.
RIT range: ±3 kHz.	As specified.
Receiver audio output: 4 W nominal.	2.88 W at 10% total harmonic distortion (THD) with an 8-Ω load.
Color: black.	
Size (H × W × D): 2.44 × 7.32 × 10.35 inches.	
Weight: 4.2 lbs.	

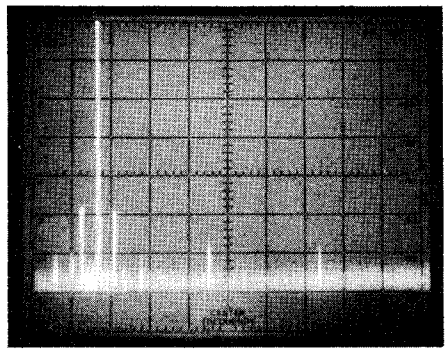


Fig 1—Worst-case spectral display of the Uniden HR2510. Horizontal divisions are each 10 MHz; vertical divisions are each 10 dB. Output power is approximately 20 W at 28.5 MHz. All harmonics and spurious emissions are at least 49 dB below peak fundamental output. The HR2510 complies with current FCC specifications for spectral purity.

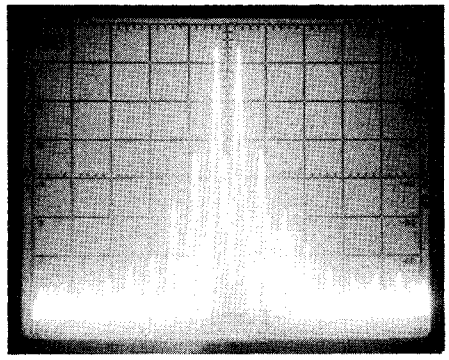


Fig 2—Spectral display of the Uniden HR2510 during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 32 dB below PEP output, and fifth-order products are approximately 45 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 20 W PEP output on 28.5 MHz.

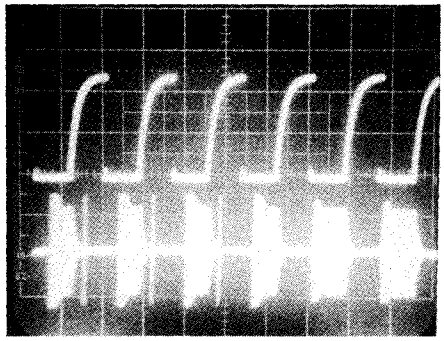


Fig 3—CW keying waveforms for the Uniden HR2510 in the semi-break-in mode. The lower trace is the RF envelope; the upper trace is the actual key closure. Each horizontal division is 50 ms. Note the unusual RF output waveform—particularly during the first three dots. The HR2510's CW keying causes audible key clicks on adjacent frequencies.

A Wrench in the Works

During the course of lab testing the Uniden HR2510, I found that the rig had a strange malady: While operating in the CW mode, the radio transmitted a short, but strong—and wide—burst of RF as the rig made the transition from transmit to receive. This noise burst occurred about 200 kHz *below* the carrier frequency in the Product Review rig. In normal CW operation, this produced a loud pop—almost as strong as the on-frequency CW carrier—in receivers tuned to the out-of-band noise-burst frequency.

I contacted Don Lane, N5NBU, of Uniden's Marketing Service Group, and discussed the problem with him. Being a ham (and all-around nice guy), Don was very helpful in resolving the problem. Uniden developed a modification to eliminate the unwanted out-of-band transmissions, and we subsequently modified and tested the Product Review unit. Sure enough, Uniden's modification solved the problem. Uniden has already incorporated a change into current production HR2510s to eliminate this problem.

Uniden has agreed to modify affected HR2510s (whether in warranty or not), mostly at their cost. The process goes like this: HR2510 owners should contact Uniden's Customer Service Department (Uniden Corp of America, Customer Service, 9900 Westpoint Dr, PO Box 501368, Indianapolis, IN 46250, tel 317-842-2483). Give them the serial number of the rig. If you have an affected unit, Uniden will give you instructions for returning the rig to them. You'll pay the shipping costs to get the rig to Uniden, and they will then modify your rig and pay the shipping costs to return it to you. Don Lane also emphasized that *any* modifications made to HR2510s by anyone other than Uniden will void Uniden's warranty.—*Rus Healy, NJ2L.*

band is particularly annoying when you're trying to tune in CW signals. The "channelized" feel of the HR2510 may reduce the quality of the rig's overall feel if used as the main station transceiver.

The UP/DOWN buttons on the front panel quickly move the operating frequency up or down the band in 10-kHz steps. The manual says that "the channel select buttons will select any 10-kHz channel in the current band segment...when tuning up and down the unit will tune to the nearest 10-kHz channel..." There are quite a few references to "channels" in the manual. (Fortunately, the 10-meter amateur band is not channelized—but the manual could mislead a noninitiate into believing that a there are a limited number of discrete channels available in Amateur Radio.)

For some reason, Uniden has divided the 10-meter band into four segments: a, 28-28.4999; b, 28.5-28.9999; c, 29-29.4999; d, 29.5-29.6999. At first glance, it appears that the HR2510 has memories; it doesn't. The channel indicator to the left of the frequency display shows which 10-kHz segment of the current portion of the band on which you are operating. The channel UP/DOWN controls simply step up or down to the nearest whole-10-kHz channel. For instance, if you've got the HR2510 tuned to 28.0313 MHz and you press the channel UP button on the mic or the front panel, the operating frequency will change to 28.0400 MHz. There are 50 channels each in band segments a, b and c, and 20 channels each in d.

If you're tuning around the band and you don't want to keep turning the clickety-click VFO knob, a touch of the SCAN button will let the '2510 do the work for you. Each time the SCAN button is pressed the rig tunes up the band looking for a signal strong enough to break the squelch, stops there until the transmission ceases, and waits another 1½ seconds. If you take no action, the scan function continues after this delay. To exit the scan mode, simply press the channel UP/DOWN buttons on the microphone or the front panel.

Operating in CW mode is fairly straightforward. If a key or keyer is connected to the rear-panel accessory plug, closing its contacts keys the transmitter (the rig uses a semi-break-in arrangement). The TR-switch hang time is approximately one second, and there is no provision for adjusting it. I had difficulty keying the HR2510 with some keyers; the on-state resistance of the outputs of some keyers is not low enough to key the rig. In some cases, keying the rig produced a sidetone, but no RF output.

One unusual—and potentially confusing—aspect of CW operation occurs when you tune the HR2510 across a CW signal. You hear the signal on both sides of zero beat, just as you would in a direct-conversion receiver. (Most modern CW receivers suppress the signal on one side of zero beat.) It is possible to tune an incoming CW signal on "the wrong sideband," in which case your carrier frequency can be as far as 1.5 kHz away from the incoming signal frequency. The HR2510 manual does not discuss this operational oddity. The correct sideband on which to tune CW signals is the lower sideband. (If you have any question, tune in CW signals in the LSB mode, then switch to CW when you want to transmit.)

As in the other modes, the RIT can be used to adjust the pitch of a received CW signal. With this rig, knowing your exact offset frequency can be a problem—the offset is not displayed. The RIT is always on, and, although there is an RIT tuning scale on the front panel, there's no center detent position that indicates the zero offset, or off position. *Here's* a place where a detent would be most welcome! The inability to turn RIT off, or at least to reliably set the RIT offset to zero, can make it difficult to answer a station on the correct frequency.

Note that although the HR2510 has FM capability, it has no provision for non-simplex operation. 10-meter FM repeaters are thus unusable with the '2510.

The HR2510 has several other interesting features, such as a generally effective noise blanker, a built-in SWR meter (useful), a modulation meter (of questionable usefulness without a variable mic gain control!), a built-in public-address system (of dubious value), and a beeper that adds a short tone to the end of every voice transmission (most people find such a beeper to be irritating).

Operating Impressions

As explained previously, getting the '2510 on the air is easy, whether the rig is in the car or your shack. I tested the rig under both conditions: At home, I hooked the rig up to a 12-V power supply and a triband beam antenna; for mobile operation I connected the rig to the car battery and a modified CB antenna. I used the rig primarily at home, however.

Once I got used to the tuning control and found the correct setting for the RIT control, everything was okay. The '2510's receiver audio sounds great—it's clean and crisp; in fact, it sounds better than the receiver audio from another transceiver I'm using that costs more than three times as much as the HR2510! The rig's AM-mode audio sounds so good that I built a single-transistor converter to listen to shortwave broadcasts using the HR2510 as a tunable IF!

On-the-air receiver comparisons were made between the '2510 and another late-model transceiver. As mentioned, the 2510's audio sounds good. Because the receiver lacks passband tuning, IF shift and other more sophisticated receiving aids (including narrow-bandwidth CW filters), the rig can't hold its own under heavy interference conditions. For casual home or mobile operating, however, the radio performs well.

One annoying receiver malady exhibited by the '2510 is AGC thumping. On loud signals, the slow AGC attack lets the received signal through relatively unattenuated at first, only to "hit it hard" shortly thereafter. The resulting pop and subsequent dramatic reduction in volume are quite noticeable.

All of the hams I worked while I was reviewing the '2510 gave the rig good marks on its transmitted audio. On-the-air tests with another late-model transceiver confirmed these reports. Of the dozens of stateside and DX stations worked, about a dozen were also using HR2510s! When asked if they liked the '2510, nearly every one responded enthusiastically. When I asked them about the tuning-knob detents, the lack of RIT offset display and the AGC thumping, they agreed (some begrudgingly) that the problems were there—but not bothersome enough to dampen their enthusiasm. All of the HR2510 owners I talked to said they would recommend the rig without hesitation. We found a rather serious problem with the rig's CW operation in the course of lab testing the '2510—see the sidebar.

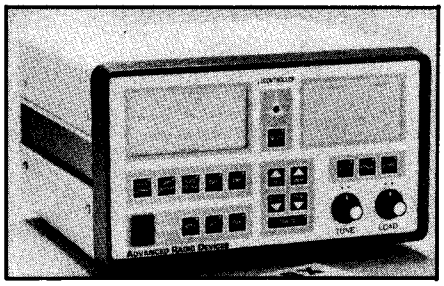
The HR2510 is great for mobile or portable operation. It would make a fantastic 10-meter vacation or DXpedition rig. It's also a lot of fun at home and, for the price, it's hard to beat. Now, if Uniden could only add 80 through 15 meters...

Price class: $269. Manufacturer: Uniden Corp of America, 4700 Amon Carter Blvd, Fort Worth, TX 76155. A service manual is available (for around $20) from Uniden Corp of America, Parts Department, 9900 Westpoint Dr, PO Box 50463, Indianapolis, IN 46250, tel 317-842-1036.

ADVANCED RADIO DEVICES 230A HF/MF LINEAR AMPLIFIER

Reviewed by Mark Wilson, AA2Z

Every now and then, a truly exciting, high-end piece of gear hits the Amateur Radio market. Often very expensive, such a product will be owned by relatively few hams, yet we all dream about having one. Over the years, for me such products have

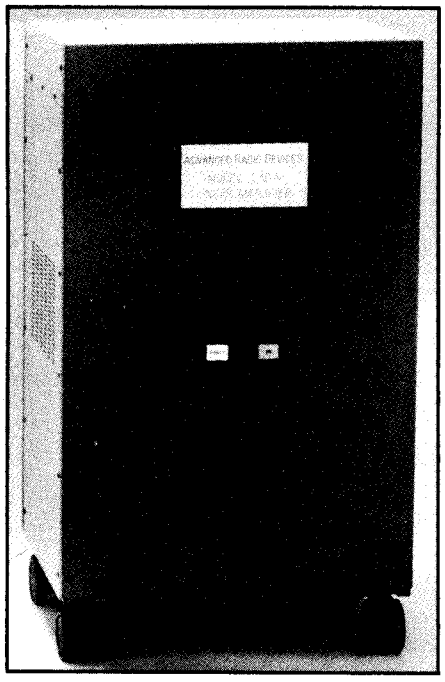


included the Telrex Big Bertha rotating pole and the Alpha 77 amplifier. The Advanced Radio Devices (ARD) 230A linear amplifier is another such product.

The 230A is a delightful mix of microprocessor wizardry and old fashioned RF engineering. It uses a pair of Eimac® 3CX800A7 high-mu triodes to deliver 1.5 kW output on the 160- through 15-meter amateur bands (excluding the new 17-meter band—more on this later). Modification for 10- and 12-meter operation can be done by licensed amateurs, as discussed later. Note that the duty cycle for 1.5 kW output is *continuous*—no time limit is specified! Other features include a vacuum relay for QSK, a pi-L output network for excellent harmonic suppression, and a forced-air cooling system.

The 230A is housed in two boxes: One contains the power supply/RF deck, and the other—much smaller—holds a microprocessor-based controller. All amplifier controls and metering required for setup and operation are housed in the microcontroller box, which is placed at the operating position. The RF deck/power supply, measuring 24 × 14 × 13 inches, can be placed anywhere up to 250 feet away from the microcontroller!

The 230A operates on 240 V ac, and



requires a service capable of providing at least 15 A. There is no provision for 120-V operation because of the high current requirements.

Microprocessor Control

Although some purists bemoan the intrusion of computer control into everything from autofocus cameras to automobile engine management systems, the fact is that microprocessor control makes possible performance—at consumer-level prices—that you wouldn't have dreamed of previously. In the 230A, the computer does not only control amplifier tuning: It also prevents damage to the amplifier by monitoring important operating parameters and taking the amp off line if critical values are exceeded.

The microcontroller front panel holds all of the controls, displays and metering necessary to operate the amplifier. On the rear panel are connections for your transceiver: KEY IN and OUT for QSK operation, PTT and ALC. There is also a multipin connector for the cable that runs to the RF deck and an RS-232-C port for remote control of the amplifier by an external computer.

In the past, several "no-tune" amplifiers have been available on the amateur market. These amplifiers usually use separate broadband pi networks that are switched in for each band. The 230A's no-tune feature is based on a different concept. In the 230A, dc motors drive the anode tuning and loading capacitors and the band switch. These motors are controlled by a Z80®-based computer with 32 kbytes of ROM, 4 kbytes of RAM and 2 kbytes of EEPROM.

The 230A has three modes of operation: automatic, semiautomatic and manual. The three modes require varying degrees of operator involvement in the amplifier tuning process.

Manual tuning is similar to that with conventional amplifiers. Press the MANUAL button and use the FREQ up and down buttons to select the desired operating frequency. Then use the TUNE and LOAD controls to tune the amplifier. TUNE and LOAD are momentary-contact switches that cause the tuning and loading capacitors to move clockwise or counterclockwise. It takes a little practice to tune "by wire" instead of turning knobs that are physically connected to their associated capacitors.

Manual tuning is also used to set up presets for the automatic and semiautomatic modes. To speed up the automatic tuning process, the positions of the tuning and loading capacitors are stored in memory for points every 100 kHz throughout the 230A's operating range. As supplied by the factory, these presets ensure proper amplifier tuning into a 50-ohm load. Most of my antennas are not perfectly matched, so I found it necessary to manually tweak the tuning on most bands. Once I entered the new preset information for my antennas in the 230A's memory, though, I did not have to manually tune the amplifier again.

Automatic and semiautomatic operation set the 230A apart from conventional amplifiers. An internal frequency counter samples the RF at the amplifier input. This frequency is shown by the FREQUENCY LCD at the upper right-hand corner of the front panel. The microprocessor reads the frequency of the drive signal, selects the correct input network and moves the anode tuning and loading capacitors and band switch to preset positions determined by data stored in memory. The whole process takes a few seconds for band changes, less for excursions within a band.

In the automatic mode, the microprocessor starts a fine-tuning process after the preset positions are reached. If you have stored the presets for your antennas as described earlier, minor adjustments to the positions of the tuning and loading capacitors occur as you move up and down a band. If you use the factory presets and your antennas are not matched to 50 ohms, the amplifier hunts for the right settings.

The semiautomatic mode is similar to automatic, except that the fine-tuning algorithm is not operational. The amplifier tunes to the 100-kHz preset closest to the operating frequency and stays put, rather than continuously hunting for the best match. As you move around a band in semiautomatic mode, the microcontroller still keeps track of your operating frequency and tunes for the closest preset. Note that you *must* tune the presets for your antennas in semiautomatic mode, or the amplifier probably *will not* be tuned correctly. After using the 230A for a while, I found the semiautomatic mode suited my needs, and I used it almost exclusively.

Metering and Safety Features

ARD has developed a comprehensive metering and safety-trip system into the 230A to help protect your investment. When you turn the unit on there's a five-minute delay while the 3CX800A7 heaters warm up. During the warm-up period, it's impossible to place the 230A in the transmit mode. Although this delay can be annoying, it's absolutely necessary to prolong the life of those expensive tubes. (Eimac specifies a minimum three-minute warm-up period for 3CX800A7s.)

The microprocessor checks the following parameters 30 times per second: anode current, grid current, heater voltage, reflected power and temperature. In addition, the microcontroller calculates anode dissipation eight times per second. As the values of any of these parameters approach the maximum safe values, a warning indicator on the microcontroller front panel flashes. For example, if grid current exceeds 100 mA, a flashing GRID CURRENT warning appears on the LCD. If the maximum safe value is exceeded (for

Table 2
ARD 230A Linear Amplifier, Serial No. 0126

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 1.75-2.0, 3.1-4.3, 5.8-8.0, 13.4-15.1, 18.5-21.6 MHz (24.8-25.0 and 28.0-30.0 MHz available for qualified users).	As specified.
Power output: 1.5 kW, continuous duty.	See Table 3.
Driving power required: 60-80 W.	See Table 3.
Intermodulation distortion: −35 dB.	Not measured.
Harmonics and spurious emissions: −45 dB.	See Fig 4.
Primary power requirements: 240 V ac at 15 A maximum.	As specified.
Color: Gray.	
Dimensions (height, width, depth): Microcontroller, 8 × 10 × 9 inches. RF deck/power supply, 24 × 14 × 13 inches.	
Weight: Microcontroller, 4 lbs; RF deck/power supply, 90 lbs.	

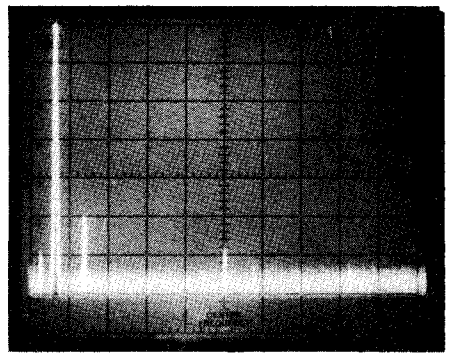


Fig 4—Worst-case spectral display of the Uniden HR2510. Horizontal divisions are each 10 MHz; vertical divisions are each 10 dB. Output power is approximately 20 W at 28.5 MHz. All harmonics and spurious emissions are at least 49 dB below peak fundamental output. The HR2510 complies with current FCC specifications for spectral purity.

Table 3
ARRL Laboratory Measurements
ARD 230A Linear Amplifier

Band (MHz)	*Anode Current (A)*	*Anode Voltage*	*Power Output (W)*	*Drive Power (W)*
1.8	1.1	2200	1500	60
3.5	1.0	2200	1500	44
7	1.15	2200	1500	50
14	1.1	2200	1500	50
21	1.05	2200	1500	50
24	1.1	2200	1500	55
28	1.15	2200	1500	60

example, 120 mA grid current), the amplifier immediately switches to standby and you must press the front-panel RESET switch to resume operation.

There is so much protection built into the 230A that it is virtually impossible to damage the amplifier. You can transmit into the wrong antenna, hit the amplifier with 150 W drive or manually mistune it. There are no fireworks—the amplifier switches to standby and displays the reason. Correct the problem and try again.

Two LCD bar graphs in the upper left-hand corner of the front panel display important amplifier operating parameters. The top bar graph displays power output (except at amplifier power-up, when it displays the time remaining in the five-minute warm-up period). The bottom bar graph is a multimeter that can separately display anode voltage, anode current, grid current, SWR or reflected power.

RF Deck/Power Supply

The RF deck/power supply is a heavy-duty rectangular gray box on casters. As mentioned before, this box is made so you can place it in any well-ventilated space up to 250 feet away from your operating position. For me, this meant placing it in the far corner of my shack so that the blower noise didn't bother me. The RF deck/power supply has two front-panel indicators, POWER and ON. The rear panel features an SO-239 for RF OUTPUT, a BNC female for RF INPUT, and multipin connectors for ANTENNA SWITCHING (DB9), ACCESSORY (DB15) and CONTROL (DB25). It also holds the main power circuit breaker, three fuses, an ALC adjustment control and a ground lug.

CONTROL is for the interconnection between the RF deck/power supply and the microcontroller. ANTENNA SWITCHING provides outputs for controlling external antenna relays. There are six outputs on the ANTENNA SWITCHING connector, corresponding to the amplifier's specified frequency ranges (see Table 1). Note that the same antenna-switching-control signal is used for 10 and 12 meters. According to the manual, the ACCESSORY jack can be used for connection of accessories such as an automatic antenna tuner, but no detail is supplied.

The plain exterior of the RF deck/power supply gives little indication of what's under the hood. Inside, the 230A is a wonderfully crafted blend of mechanical and electrical engineering. The top third of the chassis is devoted to the RF deck, and the power supply is in the bottom.

Two 3CX800A7s are mounted on a chassis along the rear wall. A huge blower, mounted to the bottom of this chassis, hangs down into the power supply compartment. It draws air through slots in the sides of the cabinet and blows it into the chassis that supports the tubes. The only way for the pressurized air to exit is through slots cut directly below the tubes. Chimneys direct the airflow through the 3CX800A7 anode coolers, and warm air exits through slots in the cabinet top and sides.

A pi input network is used for each band to provide best linearity and drive characteristics. Input band switching is accomplished by relays; the microcontroller switches in the appropriate pi network for the frequency of operation. The input module also contains the ALC circuitry, an RF wattmeter and an RF sensing circuit for driving the frequency counter that tells the microcontroller the frequency of the RF input signal.

The band switch is a heavy-duty, three-section ceramic Radio Switch Co model 86. The output network, a pi-L circuit on all bands, features air variables for tuning and loading. Various transmitting-type capacitors are switched in parallel with these variable capacitors for operation on the low bands. Drive motors for the band switch and variable capacitors are mounted to the bottom of the RF deck and hang into the power-supply compartment.

The high-voltage power supply produces 2.25 kV dc at 1.2 A for the 3CX800A7 anodes. The supply features a Peter Dahl Hypersil® transformer and a full-wave bridge consisting of four high-voltage rectifiers. Filtering is accomplished by six 240-μF, 450-V electrolytic capacitors connected in series for a total filter rating of about 40 μF at 2.7 kV.

ARD included several protective features of note in the RF deck/power supply. There are three primary interlocks (one for each removable cabinet panel), and a high-voltage shorting bar. The primary circuitry incorporates inrush-current protection for the rectifiers. Following Eimac's recommendations, ARD has included a 25-ohm, 25-W resistor in series with the anode supply to limit current to a safe value in case of a high-voltage short circuit.

As mentioned earlier, the 230A (as supplied from the factory) will not operate on the 17, 12 and 10-meter amateur bands. Getting the 230A on 10 and 12 meters is easy: Send a copy of your amateur license to ARD, along with a check for $15, and they will send you a new PROM for the microcontroller. Installation takes about ten minutes. Operation on 17 meters is

somewhat more difficult to accomplish. The amplifier was produced well before 17-meter operation was authorized for US amateurs. According to ARD, a modification will be available to allow 17-meter operation, but the amplifier will have to be returned to the factory for installation of this modification. Future production units will incorporate 17-meter operation. Contact your dealer or ARD for more information.

Setup and Operation

Our 230A arrived from the dealer in three cartons—one each for the RF deck/power supply, microcontroller and high-voltage transformer. The transformer is shipped separately to minimize the potential for damage during handling.

Setup involves two steps: removal of packing material inside the RF deck, and transformer installation. The first operation involves taking off the top panel and carefully removing packing material that holds everything in place during shipment. While removing the packing material, it's a good idea to visually inspect components and connections and check that the tubes are properly seated. There were no shipping-related problems with the review amplifier.

Transformer installation is remarkably easy. The transformer is shipped on a plate that fits a cutout in the bottom of the RF deck/power supply. Position the RF deck/power supply upside-down (casters in the air). Remove four bolts, mate two connectors, lower the transformer into place (the mounting plate has convenient handholds) and replace the four bolts. The whole operation is over in five minutes. It takes a bit of effort to turn the RF deck/power supply right-side-up—with the transformer installed, the unit weighs a hefty 90 pounds.

Interconnecting the 230A with the rest of my station was easy. ARD supplies all necessary cables, including a 15-foot control cable to connect the microcontroller to the RF deck. Longer cables—up to 250 feet—are available.

Although I've used a number of different power amplifiers over the years, operating the 230A took some practice. On most bands, 60 W is all it takes to drive the amplifier to 1.5 kW output. With the 120-W transceiver I use, I often tripped the grid-protection circuit until I hooked up the ALC. After that, no problem.

After using the amplifier for a while in the automatic mode with factory presets, I decided to tune the presets for my antennas. Manual tuning took some practice, but the protective circuitry prevented any damage. Once everything is set up, the 230A is practically an extension of your transceiver.

The 230A has one characteristic that I find bothersome. On 10 meters, it sometimes fails to keep track of the new operating frequency as you move around the band. Also, if you switch bands with the amp in the operate mode, the frequency counter sometimes fails to read the new operating frequency and the microprocessor does not tune the amplifier for the new band. (This happens when the 230A is used with an exciter that contains SWR-dependent power-reduction circuitry, as follows: In its automatic and semiautomatic modes, the 230A changes bands by sensing that the exciter has changed bands. For this to happen, the exciter must transmit RF on the "new" band at a level sufficient to drive the 230A's frequency counter. Further, the exciter must be able to transmit "new"-band RF into the "old"-band input network until the 230A senses the new frequency and changes bands. Snag: The exciter "sees" the old-band input network as a high SWR and reduces its output power to a level insufficient to drive the 230A's sensing circuitry.) The solution is simple: Switch the amp from operate to standby, briefly transmit with your transceiver, and switch back to operate. In standby, the transceiver sees the antenna and delivers enough RF for the counter to get a reading. ARD has modified the input board to make the amplifier more responsive to frequency changes, and has incorporated this change in current production units. The modification cures the 10-meter problem, and helps with the band-change difficulty.

When we first received the 230A, it did not meet spectral purity requirements because of a spurious response in the 90-MHz range. After talking with Chuck White from ARD, we discovered a missing inductor on a trap on the output board. ARD sent a replacement board, which fixed the problem. Fig 4 shows that the spectral purity of the 230A is excellent.

The ARD 230A effortlessly delivers power at the maximum legal limit, runs cool even during extended contest operation, and is virtually impossible to hurt (at least with RF!). Once the amplifier is set up for your station, you have 1.5 kW on tap without having to think much about it. I'm not looking forward to surrendering the review unit to the Product Review editor!

Price class: $5500. Manufacturer: Advanced Radio Devices, 22560 Glenn Dr, Sterling, VA 22170, tel 703-450-5595.

SOLICITATION FOR PRODUCT REVIEW EQUIPMENT BIDS

[In order to present the most objective reviews, ARRL purchases equipment "off-the-shelf" from Amateur Radio dealers. ARRL receives no remuneration for items presented in the Product Review or New Products columns.—*Ed.*]

The following ARRL-purchased Product Review equipment is for sale to the highest bidder. Prices quoted are minimum acceptable bids and reflect a discount from the purchase price.

Sealed bids must be submitted by mail and be postmarked on or before May 26, 1989. Bids postmarked after the closing date will not be considered. Bids will be opened seven days after the closing postmark date. In the case of equal high bids, the high bid bearing the earliest postmark will be declared the successful bidder.

Please clearly identify the item you wish to bid on, using the manufacturer's name, model number, or other identification number if specified. Each item requires a separate bid and envelope. Shipping charges will be paid by the successful bidder, FOB Newington. The successful bidder will be advised by mail of the successful bid. No other notifications will be made, and no information will be given by telephone to anyone regarding final price or identity of the successful bidder.

Please send your bids to Kathy McGrath, Product Bids, ARRL, 225 Main St, Newington, CT 06111.

Alinco Electronics DJ-100T 2-meter FM hand-held transceiver, s/n 0000606 (see Product Review, Mar 1989 *QST*). Minimum bid $180.

ETO Alpha 86 1.8- through 28-MHz linear amplifier, s/n 88340043 (see Product Review, Apr 1989 *QST*). Minimum bid $1997.

New Products

REPEATER AUDIO INTERFACE

☐ Creative Control Products has introduced the UAI-20 Universal Audio Interface for repeaters. The UAI-20 is a link-audio mixer providing CTCSS decoding, DTMF mute and link-audio monitoring/mixing. Among the notable features of the UAI-20 is selectable muting of DTMF tones from the repeater's transmitted audio. Price: $89 plus shipping. For more information, contact Creative Control Products, 3185 Bunting Ave, Grand Junction, CO 81504, tel 303-434-9405.—*Rus Healy, NJ2L*