Product Review Column from *QST* Magazine

November 1982

Avatar Magnetics AV-357 Power Transformer

Japan Radio Company Model NSD-515 HF Transmitter

Lambda Coaxial Portal Unit, The

Western Electronics 998BUA Trap Dipole

Conducted By Paul K. Pagel,* N1FB

Japan Radio Company Model NSD-515 HF Transmitter

I recently reviewed the JRC NRD-515 all-wave receiver.[1] So, I was also anxious to review the NSD-515 (matching transmitter in the "515" series). It covers all the amateur bands from 1.8 to 30 MHz, including the WARC bands at 10, 18 and 24 MHz. Featuring the latest technology, the '515 uses digital techniques to control the VFO system, to switch the internal filter networks and even to control an optional built-in antenna tuner!

Features

Ssb, cw and fsk are the operating modes of the transmitter. During ssb operation, an internal speech processor (which uses an rf compressor, a peak limiter and crystal filtering), can be activated to increase the effective "talk power." On fsk, the transmitter can be frequency-shifted directly by a teleprinter or by a set of dry contacts.

The front panel of the transmitter contains all the frequently used controls — VOX GAIN, ANTI TRIP and DELAY; the speech processor COMPressor control, an F-CAL/PTT/XMIT switch (used to key the transmitter manually and to spot a receiver), a multifunction VSWR/REL. POWER/IC/VC meter and switch, and the MODE switch. Both the mike and key jacks are on the front panel. Several controls on the '515 are not too common — a VFO LOCK knob prevents the unit from changing frequency. There is also a power output control knob, which works in *all* modes.

If the NSD-515 transmitter is mated with the NRD-515 receiver, the VFO of either unit can be used to control the pair as a transceiver, or the units may be operated "split" with independent VFO control. One multiconductor cable carries all the VFO signals and T-R switching lines between the receiver and transmitter.

A unique option offered with the unit is a preset, digitally controlled antenna tuner, which fits *inside* the transmitter cabinet! The circuitry consists of a series of L networks, with the amount of inductance controlled by relays, and the capacitance preset by means of trimmer capacitors. The relays are controlled by digital information sent from the BAND switch.

Circuit Features

The MHZ control, in conjunction with the main tuning dial, drives a series of TTL encoders that generate BCD data for each significant portion of the operating frequency — 0.1, 1, 10, 100 kHz, 1 MHz and 10 MHz. The 1- and 10-MHz information is decoded to switch the band-pass and low-pass filter networks, and to latch the various relays in the optional antenna tuner.

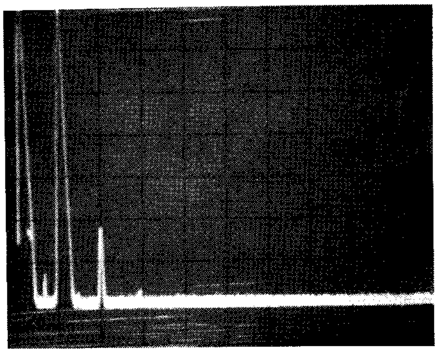


Fig. 1 — Spectral display of the NSD-515. Vertical divisions are 10 dB; horizontal divisions are each 2 MHz. Output power is approximately 100 W at 160 m. The worst-case spurious emission is approximately 52 dB down from the fundamental.

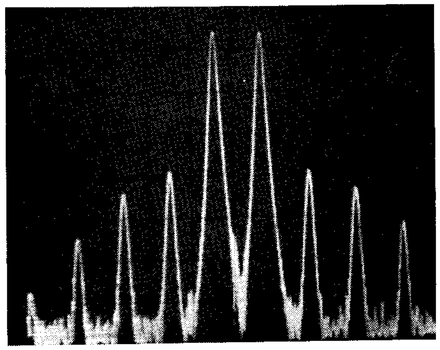


Fig. 2 — Spectral display of the NSD-515 during two-tone third-order IMD testing. The third-order products are 39 dB below PEP, and fifth-order products are about 43 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 1 kHz. The transmitter was being operated at rated input power in the 20-meter band.

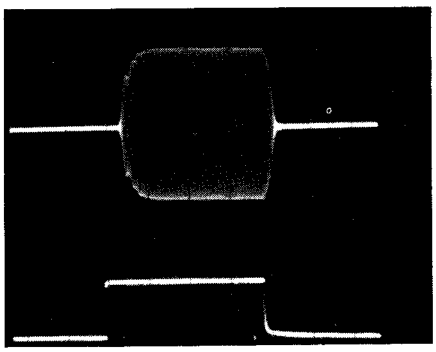


Fig. 3 — Cw keying waveform of the NSD-515. Upper trace is the rf envelope; lower trace is the actual key closure. Each horizontal division is 5 ms. Carrier level adjusted to rated input. Higher amounts of drive caused the wavefront to sharpen.

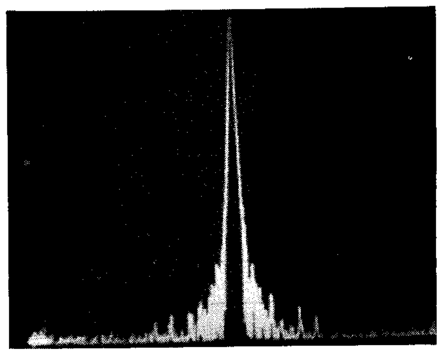


Fig. 4 — Narrow-band spectrum of the NSD-515. Vertical divisions are 10 dB; horizontal divisions are each 500 Hz. Power output is 100 W on 14 MHz. The noise at the base of the carrier is generated in the frequency synthesizer.

Signal generation in the '515 is by means of a combination of analog and digital technologies. The VFO system is entirely digital, using a shaft encoder to drive an up/down counter, which in turn determines the output frequency of the VCO. JRC engineers have done their homework in this synthesizer design: By using a high reference frequency and dividing the final output of the VCO in half, the noise sidebands of the synthesizer are reduced dramatically! The high-frequency oscillator (HFO) uses a bank of crystal oscillators. The frequency is varied by means of a Varicap® diode and the Δ-F (XIT) control. An SN76514 mixer IC is used to combine the VCO and HFO signals — a strange choice, since the '76514 is no longer available in the U.S. (something to think about when considering service).

A solid-state final amplifier is protected by control circuits that "watch" for over-temperature, excessive collector current and high VSWR. The final amplifier heat sink covers a major portion of the rear panel.

Options

Several options are available for the transmitter. These include the internal antenna tuner, an ac power supply, several types of microphones and a hand key. All of the optional items were included with the review unit.

The CFG-515 antenna coupler has a maximum tuning range of 12.5 to 150 ohms, or a 3:1 VSWR in a 50-ohm system. Maximum power rating is 150 W.

Dc power for the review unit came from the NBD-515 ac supply. This unit has a strapping bar that permits the use of 110, 117, 220 or 240-V ac. Dc output voltage is 13.8 at 15 A, *continuous duty*! A very large heat sink covers the entire rear panel of the supply.

Perhaps the most interesting option offered

[1]"Japan Radio Company Model NRD-515 All-Wave Receiver," *QST*, Nov. 1981, pp. 42-43.

*Assistant Technical Editor

Japan Radio Company Model NSD-515 HF Transmitter

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: Amateur bands — 160-10 meters, including WARC assignments.	As specified.
XIT range: Not specified.	±600 Hz.
Modes of operation: Ssb, cw and RTTY.	As specified.
Frequency display: Six 1/2" red LEDS.	As specified.
kHz/turn of tuning knob: Not specified.	10 kHz.
Power output: 100 W.	Greater than 100 W.
Spurious suppression: 50 dB or more.	Worst case: 52 dB (160 m).
Third-order IMD: Less than −31 dB, relative to PEP.	−39 dB relative to PEP.
Frequency stability: Within ±500 Hz 5 to 60 min. from power on, ±50 Hz every hour after warmup.	150-Hz drift from a cold start to 1 hour later.
Power requirements: 13.8-V dc, 20 A.	As specified.
Size (HWD): 5.5 × 13.4 X 11.8 inches.†	
Color: Gray and black.	

†mm = in. × 25.4.

with the transmitter is the KY-3A cw hand key. The base of the key weighs almost 1 lb![2] A rubber base on the key prevents slippage on the desk top.

On-the-Air Operation

Through the good graces of the people at JRC, I was able to borrow an NRD-515 receiver to mate with the unit. The package is very neat; only two cables are required to interface the units. One carries T-R control and VFO signals, the other is the receive antenna line. Once the connections are completed, the operator has the pleasure of "twiddling" the 40 switches and knobs on the transceiver!

As with most of my product reviews, I tested the pair in several contests. Contests seem to present the most demanding amateur application for receivers or transmitters. Receivers are subjected to strong local and DX signals, and filtering systems are put through the paces because of very close channel spacing. Transmitters are operated for periods of 24 or 48 hours at a time, which tests their reliability; signal-processing systems for ssb are tested by the amount of "punch" they have in a pileup.

In every contest each piece of gear performed flawlessly. Comments about the transmit audio were nothing but "great," except when the compressor control was adjusted too high. On cw, the waveform is quite hard, but no comments about key clicks were heard (even at a multi-multi effort).

One problem arose on cw — zero beating. The delta-F control on the transmitter is for vernier adjustment of the transmit frequency. The digital display in the transmitter does not reflect the change in frequency for the delta-F control, which makes exact zero beating difficult.

Those of us looking for a new rig would probably pass right over the JRC twins; after all, the product is new, and JRC is new to the U.S. Well, after talking with a few JA stations, I found out that JRC is a very old and respected manufacturer of marine communications equipment. The quality of the equipment speaks for itself. It will be hard to return the review unit to the manufacturer! Equipment prices were not available. — *Gerry Hull, AK4L*

[2]kg = lb × 0.454.

WESTERN ELECTRONICS 998BUA TRAP DIPOLE

☐ Most amateurs are willing to take a small trade-off in antenna efficiency for the convenience of multiband operation with a single antenna and feed line. Trap-style dipoles, verticals and hf-band Yagi beams are found worldwide, and many of them serve well as compromise antennas. The urban dweller or one-tower ham is a typical candidate for some form of multiband hf antenna. If a single feeder (coaxial line) is desired, then a trap (sometimes called a "trapped") type of radiator is of interest. Others prefer a center-fed or an end-fed Zepp antenna, which can be used with tuned feeders and a Transmatch. The inconvenience of a tuned feed line is the need to readjust the Transmatch each time the operator changes bands. Generally, this is not necessary when using a trap antenna.

I needed a multiband dipole for a two-week operation as 8P6EU at Barbados, W.I. Being mindful of the aesthetic quality of the beach area at Coconut Creek Club Hotel on the island, a clutter of antenna wires and feed lines was ruled out. An acceptable approach to the matter evolved from the use of a Western Electronics 998BUA trap dipole for use from 80 through 10 meters. The hotel manager had no objections to the use of the antenna when it was erected in the clear to protect the guests from accidental contact with the legs of the dipole and the feeder cable. It was erected as a sloping dipole over the seashore, with the high end approximately 40 feet above ground and the lower end about 10 feet above the sand.[3] The feed line was brought away from the antenna at a right angle, then routed to the station (a Ten-Tec Argosy).

The Antenna

Western Electronics was kind enough to ship a review unit of the 998 dipole in time for the West Indies trip. It arrived the day before our departure, which provided no time to check the system for performance. A cursory examination was carried out, however, and it became apparent that a serious problem would have to be resolved. Fig. 5 clearly illustrates the potential threat to proper operation: There is no firm electrical connection between the wire sections of the antenna and the traps. Rather, the no. 18 copper-clad steel wire terminates at each end of

[3]m = 0.3048 × ft.

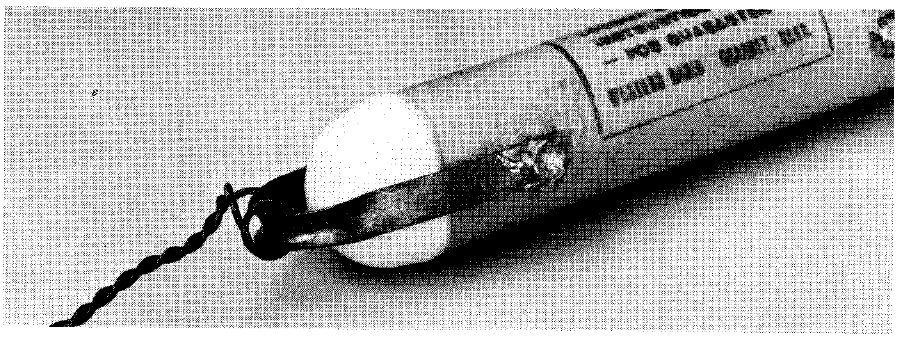


Fig. 5 — Close-up of the unmodified trap. Note the wire ring over the trap yoke, which serves as the electrical connection.

Western Electronics 998BUA Trap Dipole

Manufacturer's Claimed Specifications	*ARRL Test Results*
Antenna length: 104 feet.	Confirmed.
Feeder length: 90 feet.	Confirmed.
Power rating: 1000 W cw, 2000 W ssb.	Tested at 600 W only. No problems noted.
VSWR: 2:1 or less, all bands.	Does not conform on 80 meters (see Table 1).
Feed line: RG-58/U.	Confirmed.
Frequency range: 80 through 6 meters.	80-10 meters confirmed. Not tested on 50 MHz.
Electrical integrity: No claims.	Substandard (see text).
Physical characteristics: No claims.	Good.

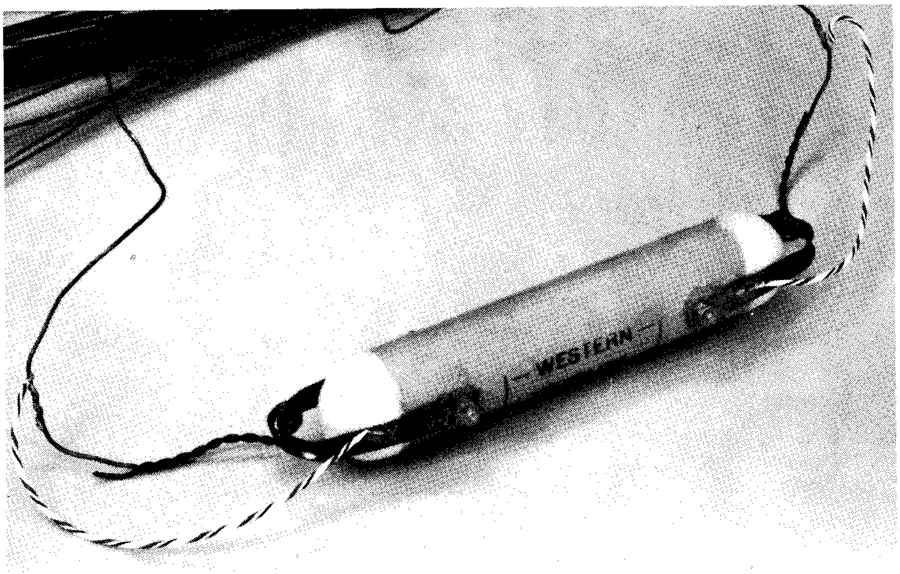


Fig. 6 — Modification of the traps to ensure proper electrical connections between the traps and the wire sections of the dipole. Lock washers have been added to the trap bolts. A coating of clear sealant was added to prevent corrosion where the yokes are mounted to the traps.

the traps in a preformed loop, which encircles the metal yoke of the trap. The instructions specify a need to ensure tension of the dipole in order to maintain electrical contact. This is in sharp contrast to fundamental procedures for electrical connections, especially those used in an outdoor environment! I observed also that the no. 6 studs and nuts that held the yokes on the traps were loose and without lock washers — another potential problem in the presence of wind and corrosion. Something had to be done before the antenna was erected in a salt-air locale!

Fig. 6 illustrates the quick preventive measure taken at each of the two traps. A length of stranded hookup wire (no. 22) was used as a jumper connector soldered from the antenna wires to the yokes on the traps. I strongly recommend that the manufacturer adopt this change. It was deemed important also to install lock washers at each of the yoke attachment points, then coat the hardware with noncorrosive sealant (see Figs. 5 and 6). These changes were vital to reliable performance, as salt air (or acid in the smoke and smog of cities) will tarnish and corrode a copper surface in a few hours, causing poor electrical joints. The copper surfaces of the trap antenna turned green during the first 24 hours of use on Barbados!

The 988 has one trap in each leg of the dipole. The traps are resonant in the 40-meter band. The more elaborate Western Electronics dipoles contain traps for the discrete bands of operation, thereby permitting the antenna to function as a half-wavelength dipole on each band of interest. The 998 does not perform in this manner on 20, 15 and 10 meters. It does, however, seem to present a current node for those bands at the feed point.

A 90-ft length of RG-58/U coaxial cable is supplied with the dipole. No brand name could be found on the gray-colored cable, but it was quite flexible and soft, making it easy to route around corners and into the hotel room. I did not perform loss tests on the line (50-ohm load and wattmeter), so the quality of the line is unknown.

Dacron guy line (rated at 300 pounds test) is supplied in two 15-ft lengths — one for each end of the antenna. A built-in lightning arrestor and static-drain resistor is located at the center insulator of the dipole. I sealed the open end of the coaxial cable where it emerges from the center insulator and joins the legs of the antenna; this spot seemed vulnerable to weather effects also. The feed line is terminated at the station end in a PL-259 type of connector.

Western Electronics specifies band coverage from 80 through 6 meters with the 998BUA. I did not test the system on 6 meters. Also, it is rated (guaranteed) for 1000 W on cw and 2000 W on ssb. My strong preference for a feed line at those power levels would be RG-8/U, but I have "pumped" 600 W into RG-58/U and RG-59/U with no ill effects when my antennas had a VSWR below 2:1. But, I have also melted the smaller lines with a 600-W output-power level when a high VSWR existed. This happened during an ice storm in New England. Beware!

Antenna Literature

A large collection of tutorial and supporting literature was shipped with the antenna. Some of it made very interesting reading, but other parts caused me concern because of technical misinformation. The misspelled words did not create any problems in comprehending the instruction sheets. Some of the statements are worth quoting:

1) "We have made hundreds of tests and found that when a coaxial feedline is long enough so that it is over one-quarter wave length long electrically at the lowest frequency, the antenna used on the feedline acts as a balun, and the RF currents equalize BEFORE they get to the antenna itself."

2) Concerning how much voltage is on each side of a dipole, the manufacturer recommends ". . .or you may prove it yourself, by simply drawing an arc off of each end of the antenna and compairing [sic] both sides while the transmitter is operating and feeding the antenna power *(use a lead pencil).*" Emphasis has been added by the reviewer, for this type of practice can be very dangerous, and it is not recommended. Also, an arc of such magnitude can send a large transient down to the transmitter, thereby posing a serious threat to a solid-state final amplifier stage. It also can cause RFI and TVI.

3) "The traps have zero losses."

4) "Anything above 15 feet will work well." [*Concerning antenna height* — Ed.]

5) "The height above ground has nothing to do with matching the SWR to the feedline, or feedline to transmitter, and it will not increase radiation efficiency of the antenna."

There are a number of similarly "interesting" statements contained in the antenna literature provided by the manufacturer, but we'll save that reading for you when you purchase your dipole.

Performance

I was glad I took a Transmatch and VSWR indicator with me to 8P6 land, for the SWR-protected transceiver I used would not operate effectively into the dipole without my creating a 1:1 condition at the station end of the feed line. This is typical of any well-designed solid-state transmitter that contains a VSWR shutdown circuit for the protection of the PA transistors.

Excellent results were obtained on 80 and 40 meters while using the trap dipole. I was able to work the world on cw with approximately 40 W of output power. Performance on 20, 15 and 10 meters was not spectacular, owing in part to poor daytime band conditions. I solved the problem to some extent by building a 20-meter dipole with tuned feeders, which was also erected as a sloper. It worked quite well on 20, 15 and 10 meters. At times, both antennas

Table 1

Measured VSWR Bandwidths

Band (meters)	*Lowest VSWR (MHz)*	*Band Edge (MHz)*	*Band Edge (MHz)*
80	2.1:1 — 3.850	2.9:1 — 3.500	2.5:1 — 4.000
40	1:1 — 7.150	1.8:1 — 7.000	1.8:1 — 7.300
20	1.3:1 — 14.350	1.6:1 — 14.000	1.3:1 — 14.350
15	1.9:1 — 21.450	1.9:1 — 21.000	1.9:1 — 21.450
10	1.7:1 — 28.000	1.7:1 — 28.000	2:1 — 29.700

Measurements were made by means of a Bird Thruline wattmeter, courtesy of ARRL Laboratory Technician Mike Kaczynski, W1OD. Readings on 15 and 10 meters are "apparent VSWR" indications, owing to the effects of the 90-foot RG-58/U feed line. Tests were not performed on 6 meters, although the antenna is rated for use on that frequency.

yielded similar signal reports on the three upper bands, but at other times the 20-meter dipole exceeded the performance of the 998 by two or three S units. I attributed the difference to the effective angles of radiation of the two antennas, respective to the time of day and propagation conditions.

Upon my return to the USA, the trap dipole was erected high and clear at ARRL Hq. Table 1 shows the measured VSWR on the bands from 80 through 10 meters. Western claims a 2:1 VSWR (or less) on all bands. I found this to be true on the specified frequencies other than 80 meters. The antenna was exceptionally handy and easy to erect, and was well suited to air travel in terms of weight and bulk. I strongly suggest that prospective buyers of this and similar Western Electronics models of antenna give consideration to performing the same type of "surgery" that I applied. The procedure will negate the occasion for intermittent operation, stray rectification, TVI and RFI.

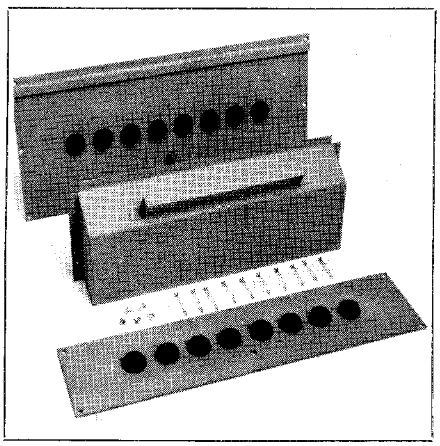
This antenna is distributed by Western Electronics, Kearney, NE 68847. Price class: $80. — *Doug DeMaw W1FB*

THE LAMBDA COAXIAL PORTAL UNIT

□ Most amateurs have faced the problem of bringing their transmission lines through the outside wall of the house. With a single coaxial cable it's not difficult to do, but as the "antenna farm" grows, so does the problem. If you have five or six feed lines plus a rotator control cable or two, drilling holes through a window frame isn't likely to be a satisfactory solution.

The Lambda feedthrough panel is a *good* solution to the problem. With it you can bring up to eight cables through the wall without worrying about water leaks or drafts. Two 16-gauge aluminum panels, a protective cover and all the necessary hardware are supplied with the unit. The larger of the two panels, measuring 16-1/2 × 8 inches, mounts on the outside surface of the wall.[4] The smaller panel (16-1/2 × 4 inches) is attached to the inside wall surface. Both panels have eight holes, each fitted with a heavy rubber grommet that will accept cables up to 1/2 inch in diameter. The grommets prevent chafing of the feed-line insulation and also seal any unused holes. The protective cover attaches to the outside panel, shielding the holes from the elements. All the aluminum parts are painted with zinc-chromate primer. This produces a highly durable surface that readily accepts finish paints.

[4] mm = in. × 25.4



Installation

Installing the Lambda panel is easy. It is designed to mount between studs located 16 inches apart (center to center). After locating the studs, cut a rectangular hole in both wall surfaces, following the dimensions given in the instructions. Then fasten the outside panel over the hole with six woodscrews. A braided copper strap is supplied for connecting the panels together so that both can be effectively grounded. With the braid in place, pass the cables through both panels and attach the inside panel to the wall. Connecting a ground wire to the threaded stud provided on the outside panel and fastening the protective cover in place completes the installation.

If the cables do not have connectors attached to them, you will be able to pass them through the rubber grommets without removing the grommets from the panel. To install cables fitted with connectors, you must remove the grommets. They can then be carefully cut with a sharp knife and slipped over the cable. The holes in the panels are large enough (13/16-inch) to accept uhf (PL-259) or type-N (UG-21) connectors. With emphasis today on energy conservation, you will want to fill the space around the cables with fiberglass insulation to reduce heat loss.

When carefully installed and finished, the Lambda panel is an attractive, convenient solution to a sometimes difficult problem. The Lambda Coaxial Portal Unit is manufactured by Lambda Vector Corp., P.O. Box 35, Rte. 1, Monterey Rd., San Miguel, CA 93451. Price class: $50 — *George Collins, KC1V*

AVATAR MAGNETICS AV-357 POWER TRANSFORMER

□ A popular construction project in *The Radio Amateur's Handbook* since the 1981 edition has been the 300- to 400-W 13.8-V power supply. The major stumbling block for would-be builders has been the lack of a commercially available transformer. Despite copious information in *QST* and the *Handbook* on rewinding transformers, many people are put off by the effort and uncertainty involved.

All that's changed with the introduction of the AV-357 by Avatar Magnetics. Ron Williams, W9JVF, designed the unit to the specifications given in the *Handbook* article. Taking special note of the critical requirement for precise rectifier voltage to maintain regulation and minimize dissipation, Ron tapped the primary winding in five places to provide optimum rectifier input. Another use for these taps is to compensate for line voltage variations.

Fig. 3 shows the AV-357, and the accompanying table lists the specifications. Anyone who's seen the photos in the *Handbook* will be impressed that the Avatar unit does the job of the *Handbook* transformers with less than half the volume. The obvious benefits of using a smaller, lighter transformer are enclosure compactness (easier to fit in the shack) and a lighter foundation (no need for expensive 1/8-in. aluminum plate!) The trade-off is that such a compact assembly must be designed to ventilate the transformer and prevent it from heating the already heavily taxed transistor heat sink. In the *Handbook* supply, the transformer ran practically cold at the rated load. The compact AV-357 unit naturally runs quite a bit warmer — not so hot as to take the skin off your fingers, but hot enough to affect any nearby sensitive regulator components. I tested the AV-357 in free air for eight hours using a 400-W load consisting of a parallel bank of five 5-Ω 225-W resistors (I knew they'd come in handy some day!). It's definitely a heavy-duty piece.

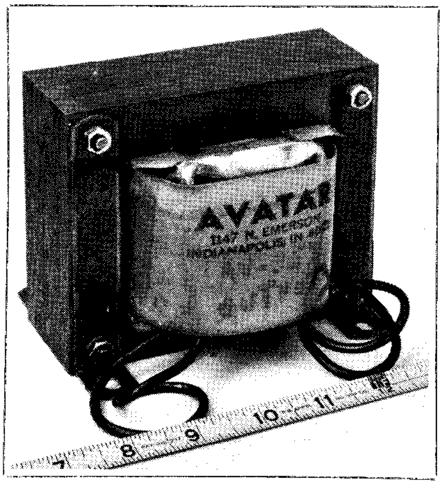


Fig. 3 — The Avatar Magnetics AV-357 transformer, designed for use in the *Handbook* 300- to 400-W power supply.

Avatar Magnetics AV-357 Power Transformer

Manufacturer's Claimed Specifications†

Input excitation: 117 V, 60 Hz

Output voltage vs. load current:

Primary tap	*Open*	*20 A (100% duty)*	*30 A (25% duty)*
1	21 V	20 V	19.5 V
2	20	19	18.5
3	19	18	17.5
4	18	17	16.5
5	17	16	15.5

Dimensions: 5-1/4 × 4 × 4-1/2 in.
Weight: 13 lb.

†Verified in the ARRL laboratory.

At 400 W of secondary output, the measured primary current at 117 V was 4.4 A for an efficiency of 77%. The primary magnetizing current was 330 mA, using the tap yielding the highest secondary voltage. All of these tests were performed at 60 Hz. No information is published for 50-Hz operation, and no power generator for that frequency exists in the ARRL lab. (I approached several of the staff audiophiles, but none was willing to subject his amplifier to so severe a test!) However, the designer suggests 20% as a reasonable current derating factor for 50-Hz applications.

The AV-357 removes a significant impediment to the home construction of 13.8-V power supplies for transmitting service. If you don't know why you should build your own supply instead of buying an "accessory" unit for your transceiver, see the *Handbook* article. Avatar Magnetics can custom-wind transformers for any load from 200 to 2000 W. Price of the AV-357 is $35 plus shipping. Avatar's address is 1147 North Emerson, Indianapolis, IN 46219. — *George Woodward, W1RN*