Product Review & Short Takes Columns from *QST* Magazine

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Product Reviews

Short Takes

MFJ-9340K QRP-Cub Transceiver Kit

Reviewed by Rich Arland, K7SZ
QST *Contributing Editor*

Bottom Line

Employing a combination of space-saving factory installed surface mount components and user-installed though-hole components, the tiny Cub represents a whole new concept in kit construction.

If you have a passion for low power communications (QRP), you are probably already aware of the tremendous selection of kits that are available to those participating in this facet of the ham radio hobby. QRP transceivers, transmitters and accessory kits abound. The QRPer is faced with a staggering array of choices regarding what to buy and from whom.

A long-time supplier of Amateur Radio products, MFJ Enterprises, has thrown their hat into the QRP kit ring with the introduction of their "Cub" CW QRP transceivers. (Factory wired and tested versions are also available.)

I have owned a variety of MFJ gear since 1973. I toured their factory in 1974 (at the time it was in a mobile home on lot #1, Luxury Mobile Homes, on Highway 25, just outside of Mississippi State College) and, in an article for Ade Weiss' *The Milliwatt—The National Journal of QRPp* (the December 1974 issue), I predicted that we would see big things in the future from MFJ. If the usual array of full-page ads in each issue of *QST* over the last several years serve as any indication, I think you'll agree that my prediction was correct. Without a doubt, MFJ Enterprises is a major player.

The Cub

The MFJ QRP-Cub was designed by QRP-ARCI Hall-of-Famer Rick Littlefield, K1BQT, and is a quasi-radical departure from the majority of QRP transceiver kits currently available. Like many of the alternatives, it is a monoband CW rig (available for 80, 40, 30, 20, 17 and 15 meters) with a superhet receiver and crystal filtering, but this is where the similarities end. Unlike the "through-hole" component kits that we've come to know and love, the Cub also employs lots of surface mount (SMT) components.

If you have yet to work with surface mount parts and are wondering if you have the necessary level of dexterity and acuity of vision to install them, relax… the precision automated equipment on MFJ's factory production line has already installed those components for you. All that is left for the Cub kit builder is to solder in the remaining conventional through-hole components—a few capacitors, some connectors, trimmer caps, inductors and variable resistors—wind and install a couple of toroidal inductors, align the rig and assemble the enclosure. Pretty simple, eh?

Assembly

For me, the choice of which band version to build was easy—40 meters. Forty is my all-time favorite QRP band—you can usually scare up a contact any time of the day or night.

Having built many kits (including some using SMT devices, incidentally), I wouldn't think that the beginning builder would find the Cub kit to be at all intimidating—especially since all of the SMT components are already installed!

I began the construction process with a quick inventory of the parts (*always* inventory a kit before you begin putting it together… believe me, it can save you valuable time and lots of hair pulling later) and was soon blissfully engaged in stuffing leaded components into the board.

This was the first MFJ kit I've built, so I paid particular attention to the instruction manual. One missing "builder comfort" that I would have appreciated having is parts placement and tune up control location diagrams on separate foldout or tear-out sheets. This would eliminate the need to flip back and forth between manual pages as building and alignment progresses.

Overall, I found that the instructions were clear and, with the exception of one BIG faux paux on my part, the rig went together relatively uneventfully.

A few words about solder for the benefit of first time kit builders—and perhaps even a few of the old pros. For as long as I can remember I have used Kester 60/40 rosin core solder for all of my electronic kit building and associated projects. This all changed when I purchased my Elecraft K2 kit a few months ago.

Figure 1—MFJ-9340K QRP-Cub transceiver kit includes a $3\frac{1}{4} \times 3\frac{1}{4}$-inch PC-board with pre-mounted surface mount components, three bags of user-installed parts and a complete enclosure package.

Joe Bottiglieri, AA1GW ♦ Assistant Technical Editor

Table 1
MFJ-9340K QRP-Cub Transceiver

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive and transmit, any 60 kHz portion of the 40-meter band.	As specified.
Power requirement: Not specified.	Receive, 41 mA; transmit, 270 mA. Tested at 13.8 V.
Modes of operation: CW.	As specified.
Receiver	*Receiver Dynamic Testing*
CW sensitivity: <0.3 µV.	Noise floor (MDS): –132 dBm.
Blocking dynamic range: Not specified.	Blocking dynamic range: 101 dB.
Two-tone, third-order IMD dynamic range: Not specified.	76 dB.
Third-order intercept: Not specified.	–18 dBm.
Receiver audio output: Not specified.	437 mW at 10% THD into 8 Ω.
IF/audio response: 750 Hz.	Range at –6 dB points, (bandwidth): CW: 300-900 Hz (600 Hz) (user adjustable).
Spurious and image rejection: Not specified.	First IF rejection, 90 dB; image rejection, 81 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output: 2.2 W typical.	1.9 W.
Spurious-signal and harmonic suppression: Not specified.	–43 dB. Meets FCC requirements for spectral purity.

Size (hwd): 2.0×3.63×3.75 inches; weight, 8.2 ounces.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

Third-order intercept point was determined using noise floor reference.

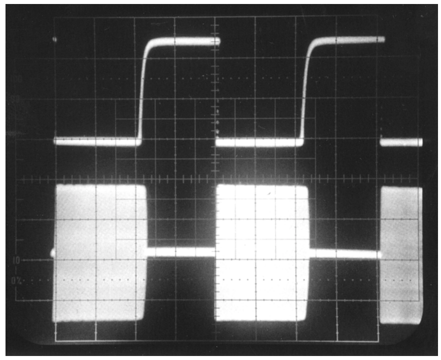


Figure 2—Keying waveform for the MFJ-9340 QRP-Cub showing the first two dits. The equivalent keying speed is 60 WPM. Horizontal divisions are 10 ms. The upper trace is the actual key closure; the lower trace is the RF envelope. The transmitter is being operated at 2 W output at 7.020 MHz. The rise time is quite fast and may generate some key clicks.

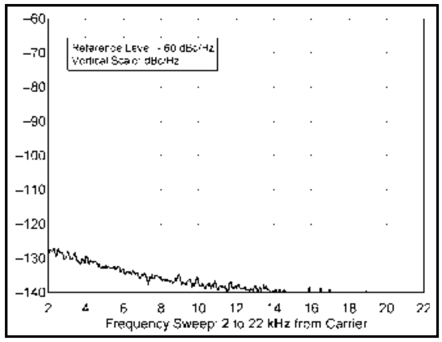


Figure 3—Spectral display of the MFJ-9340 QRP-Cub transmitter output during composite-noise testing. The carrier, off the left edge of the plot, is now shown. This plot shows the composite transmitted noise 2 to 22 kHz from the carrier. The transmitter is being operated at 2 W PEP at 7.020 MHz.

Elecraft strongly recommends that the K2 builder use 2% silver solder to assemble the rig. I bought one roll of Kester 24-7150-8800 "no-clean" 2% silver solder and will *never* go back to 60/40.

This solder leaves virtually no flux on the PC board, eliminating the need to scrub the surface of the finished board to remove any residue. The soldering on the board even looks much more professional and the chance of producing a high impedance path due to excessive flux is nonexistent. Needless to say, the Cub got the silver solder treatment.

My one construction error is directly related to "operator headspace." When I reached the step where the on/off switch is mounted to the circuit board, I ran into trouble. The pins of the PC-board mounted switch were too large to fit into the holes provided in the board. Without giving it a second thought, I chucked the #64 bit into the Dremel MotoTool and enlarged the holes. The switch fit just fine then, but when it was time for initial testing, I couldn't power the rig on!

Needless to say, I immediately suspected that the problem was related to the switch. Closer inspection revealed that the holes were initially plated-through and that, by drilling them out, I had removed the plating that provided a path between traces on the top and bottom of the board! Naturally, I attempted to solder the switch pins to the topside pads by slipping the soldering iron tip into the small space between the top of the board and the underside of the switch. This resulted in utter destruction of the switch (I absolutely love it when a plan comes together!).

A quick call to MFJ, and a replacement switch was on the way. I ended up permanently bridging the damaged solder pads together and mounted the new switch in place. The switch is now purely cosmetic, but it does fill the hole in the front panel nicely!

What's the lesson here? If you run into a snag during any project, take some time to think through your course of action. Had I done this (or contacted MFJ's tech support personnel for suggestions), I might have filed down the switch's pins to fit the PC board holes instead of drilling out the holes to accommodate the switch pins (and destroying the through-hole plating in the process).

I discussed this unfortunate experience with the folks at MFJ. They told me that they were aware of the problem—it only occurred with a handful of kits—and have corrected it. Edsel Murphy lives, what can I say?

It took me about six hours to complete the transceiver, including alignment. The tuning range I measured on my frequency counter was about 60 kHz. I set up mine to cover from 7.000 to 7.060, but the Cub is capable of tuning any 60 kHz portion of the 40-meter band. The alignment instructions are very good, as is the explanation of how to set up the zero beat on the BFO.

The front panel arrangement is the epitome of simplicity. The only controls are the power pushbutton, the volume control and the main tuning knob. There's no built-in speaker—a 3.5 mm **PHONES** jack is provided.

Rear panel connection points include a 3.5 mm key jack, a coaxial-style dc power socket and a phono jack antenna connector. A punch-out in the panel for a BNC antenna connector is provided for those that might prefer to install that type.

The manual includes a brief troubleshooting section along with IC and transistor voltage charts to help cure any maladies. Our Cub went together without any major problems (other than the switch) and the alignment was performed without difficulty.

Catch a Wave

I wired the Cub to my power supply, plugged in my key and headphones, connected my 40-meter extended double Zepp through an antenna tuner, and was rewarded with a rush of signals. I tuned around a bit and found a station calling CQ and gave him a quick call. He came back with a 579 report—not bad considering I was transmitting with just 2 W of RF power!

I am suitably impressed with the MFJ Cub—the more I operate it the more I like it. It's important to keep in mind that the Cub was never intended to be a "contest" radio—it's designed to be a simple, relatively inexpensive transceiver for casual QRP operating.

Since the Cub uses only a 3-pole IF crystal filter, there is some filter "blow by," and during evening operation I also noticed that, at least here in the northeast, the 40-meter version is prone to shortwave broadcast overload. CW break-in is semi-QSK.

One operating characteristic that takes a little getting use to is that the main tuning dials on the 40- and 80-meter Cubs work backwards! You turn the tuning knob clockwise to move down in frequency.

Overall, the performance ain't bad.

Room to Grow

Now that I've completed the kit and verified that it's working properly, in typical QRPer fashion, I'm already considering how I'd customize it. I'd build in a PIC-based memory keyer (such as the TiCK or K1EL variety) and maybe add an audio frequency enunciator like the Small Wonder Labs FREQ-Mite. There's plenty of room inside the case.

The manual lists several power amplifier transistors that can be substituted for the stock 2N5109 that comes with the kit. I had a 2N3553 on hand and have already tried installing that device in place of the normal PA with good results.

I also performed one other modification—I've replaced the main tuning knob with a knob of much larger diameter. This greatly enhances the ease of tuning.

The Scouting Report

The Cub is geared for the backpacker, hiker or QRPer on the go. The rig can be powered by a battery pack made from a handful of AA cells or, if space and weight isn't a major consideration, a gel cell. A collection of two or three Cubs covering a variety of bands could be the start of a great little portable station for camping, business trips or vacations.

The construction of the Cub is pretty easy. It seems to me to be an excellent choice for a first time kit builder. If you are not interested in spending a few enjoyable hours at the bench, you can order the unit factory assembled.

The performance is decent—especially when you consider the simplicity of the design, the price and the intended market. Those who haven't experienced QRP operation yet will be surprised with how well they can do using just a couple of watts and a simple antenna.

Manufacturer: MFJ Enterprises, PO Box 494, Mississippi State, MS 39762; 800-647-1800, fax 662-323-6551, **http://www.mfjenterprises.com/**.

Manufacturer's suggested list price: $99.95 (kit); $149.95 (wired and tested).

Switching Power Supplies Revisited

Reviewed by Joe Bottiglieri, AA1GW

A comparison product review covering the Astron SS-30M, the ICOM PS-85, the Kenwood PS-40, the MFJ-4225MV, the Samlex SEC 1223 and the Yaesu FP-1023 switching power supplies appeared in the January 2000 issue of *QST*.

Since then, two additional manufacturers have added switching supplies to their product lines. This time around we'll put Alinco's DM-330MV and Diamond's GZV4000 through their paces. Please have a look back at the earlier review to get a complete picture of how these new contenders stack up against their predecessors.

We had hoped to take this opportunity to check out an updated version of ICOM's PS-85. The example of that supply that we evaluated in the previous review exhibited some disappointing performance. At that time, communications with ICOM America indicated that an improved version would be available by the time that the January 2000 issue of *QST* had hit the streets. Unfortunately, due to engineering delays (and contrary to what I reported in the text of that review), a redesigned PS-85 has not yet become available.

A Transformation

Perhaps the most noticeable advantages of switching supplies over their more conventional transformer-based cousins are reductions in size and weight. This makes them especially attractive choices for portable applications, such as for travel or for use in the field. If the trends that we are seeing in the power supplies of consumer electronics products are any indication however, switching supplies will be finding their way into more and more ham shacks—weight and size considerations may soon give way to the forces of simple economics.

While early "switcher" designs proved too electrically noisy for use with our sensitive receivers, the results of our January review prove that most of the currently available "communications grade" switching power supplies are sufficiently quiet for the vast majority of Amateur Radio use.

The Tests

We subjected the Diamond and Alinco supplies to the same battery of tests that we used for the previous evaluations. These include measurements of the dc output voltage at loads of 1.1 and 21 A, the minimum ac input voltage required for the supply to retain proper dc regulation and the amount of dc ripple present on the output.

We also put them through the same dynamic test—the supply is connected to a test fixture that rapidly alternates the load between approximately 1.1 and 21 A and the resulting variation in the output voltage is recorded.

The final—and perhaps the most revealing—lab test involves ac coupling the supply to a spectrum analyzer, connecting a load of approximately 20 A, and generating a spectral plot of the frequencies between 1.5 and 100 MHz.

As before, the supplies were field tested by substituting them for the existing dc power supplies in a variety of station configurations.

The Alinco DM-330MV

The DM-330MV is one of the smallest of the switching power supplies that we've looked at so far, but—paradoxically—it is

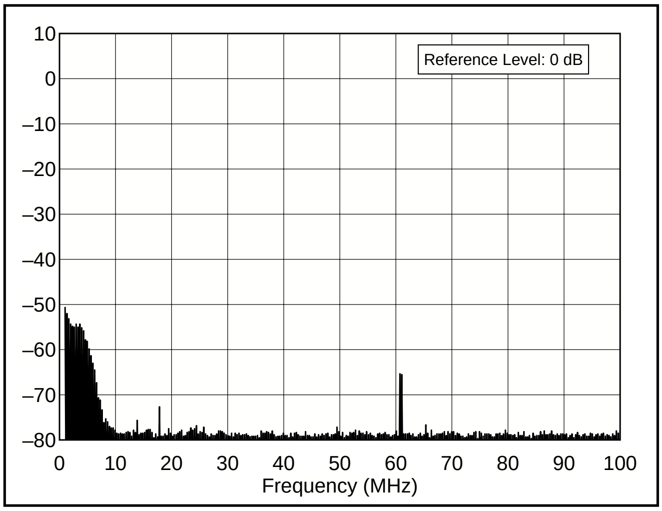


Figure 5—A spectral plot of the output of the Alinco DM-330MV under load. This supply exhibited low levels of broadband noise. The peaks that do appear lie primarily below approximately 7 MHz.

also the most feature-packed.

The entire top cover is a finned anodized aluminum heat sink. The enclosure is finished in dark bronze and the controls and connections are labeled with gold lettering.

The front panel includes a large backlit voltage/current meter, a 10-A cigarette lighter-style dc socket and two pairs of 5-A push-in terminals. Rocker switches are provided for power on/off and for selecting either voltage or current metering.

There is also a set of dual concentric rotary controls. The outer ring controls the output voltage, which is variable from approximately 5 to 15 V. A detent in the midway point of this control's rotation corresponds to 13.8 V out. The inner knob is a "noise offset" control—more on this later.

Large widely-spaced binding posts, for supplying loads that draw up to 32 A, are provided on the back panel. The ac power cord is not removable and 220 V operation is not supported (the manual lists a different model for 220 V ac applications).

The back panel also includes a small cooling fan, a fuse for ac line protection, a station ground attachment point, a **PRESET** switch, a recessed **PRESET ADJUST** potentiometer and a 3.5 mm **REMOTE CONTROL** jack.

The "preset" feature allows you to lock the supply's output at a specific dc voltage (the factory default setting is 13.8 V). When the preset slide switch is in the on position, the voltage adjustment control on the front panel is disabled.

This feature is handy when using the supply to power the typical transceiver. It eliminates the possibility of accidentally varying the dc voltage with the front panel control to a level that is outside of the radio's specified voltage range. The screwdriver adjustable **PRESET ADJUST** control allows you to change this fixed voltage to any value between 5 and 15 V dc.

The **REMOTE CONTROL** jack can be used

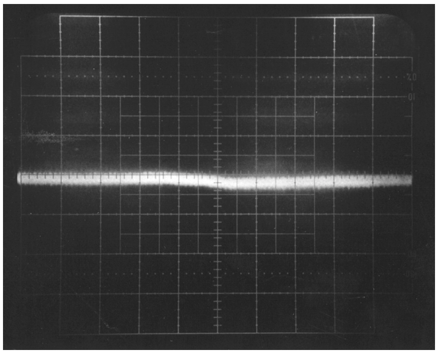


Figure 4—An oscilloscope trace of the dc output of the Alinco DM-330MV while operating under a 20 A load. The vertical scale is 5 mV/div and the horizontal scale is 5 mS/div. The level of dc ripple is very low, approximately 1 mV p-p, and there are no discernable spikes.

Table 2
Alinco DM-330MV
serial number M0000797

Manufacturer's specifications

Power requirement: 120 V ac.
Output voltage: 5.0-15.0 V dc.
Output current (continuous): 30 A.
Size (hwd): 2.64×6.9×6.5 inches; weight, 4.4 pounds.

Lab Measurements

Output voltage, no load: 13.47 V dc.
Output voltage, 21 A load: 13.15 V dc.
Low line drop out voltage: 75 V ac.
Dc variation during dynamic testing: ≈40 mV.

to connect an external control for the supply's output voltage. A simple schematic for constructing the remote control head, which consists of a variable resistor and two fixed resistors, is described in the documentation. When a plug is inserted into the jack, the remote feature is automatically enabled and the preset feature and the front panel **VOLTAGE ADJUST** control are disabled.

A particularly interesting—but somewhat illusive—feature is the "noise offset" system. If you encounter a situation where pulse noise generated by the supply is causing interference to a specific frequency of interest, you can use the front panel **NOISE OFFSET** control to "move" the interference. Unfortunately (or perhaps *fortunately*?), we were unable to locate any supply-generated interference in the receivers in the course of field testing to use to investigate this system's effectiveness—a testament to the spectral "cleanliness" of the DM-330MV's output (see Figure 5).

Automatic protection circuits, for short circuit, over-current and over-temperature, are included.

The 5 to 15 V dc voltage output range and the nice selection and sensible location of dc connection points make this unit a particularly good choice for someone looking for more than just a dedicated transceiver supply. The DM-330MV is well equipped to pull double-duty as a test bench supply. The only power supply in our previous review that offered a front panel control to vary the dc output was the MFJ-4225MV—and that was limited to between 9 and 15 V dc. (Read on though, the Diamond supply features variable dc output as well.)

The high current (32 A maximum) terminals are located on the back panel—and this is the intended connection point for 50 to 100 W+ transceiver power cords. This leaves the front panel 5 A push-in terminals and the cigarette lighter socket readily available for test bench or accessory applications.

If you have a temporary requirement for a dc voltage other than 13.8 V—for testing a homebrew circuit for example—simply disconnect (or shut off) the station transceiver, set the dc voltage to the desired level, connect the device and you are good-to-go.

The cigarette lighter socket allows you

to use lighter plug equipped vehicle power cords that you may already own for H-Ts and mobile accessories to conveniently power these devices in the home station.

The DM-330MV is a very quiet supply, both electrically and acoustically. The tiny cooling fan is temperature controlled—but even when running it's virtually silent.

When the '330MV was substituted for conventional transformer-based supplies, no increase in broadband noise or spurious signals within the tuning range of the connected HF transceivers, or changes in the transmitted signal, were observed.

The unit does get very warm during relatively high current operation. Thirty minutes of continuously supplying 13.8 V to a 21 A load (this approximates the power requirement of a 100 W-class transceiver transmitting at full output for 30 minutes straight at 100% duty cycle) brought the temperature of the top cover/heatsink to the "untouchable" level. While the supply did throw off a considerable amount of heat, it did not get hot enough for the over-temperature protection circuitry to kick in. With a rated continuous-duty current rating of 30 A—we probably didn't even come close. A yellow label on the enclosure warns of the potential for high surface temperatures. Believe it.

The documentation packed with the DM-330MV is a single folded 20×14½-inch sheet—English instructions are on one side, Japanese are on the other. It includes specifications, identification of controls and connection points, construction details for the remote control and an extensive collection of "Danger," "Caution" and "Warning" notices. No schematic diagram is provided.

The Alinco DM-330MV is small and light enough for easy portability in the field, yet it also offers multiple connection point alternatives, high current producing capabilities and impressive dc output voltage control flexibility. These attributes make it a great choice for fixed station, portable and test bench applications as well.

Manufacturer: USA Alinco Branch, 438 Amapola Ave, Torrance, CA 90501; 310-618-8616; fax 310-618-8758; **http://www.alinco.com**.

Manufacturer's suggested retail price, $219.95. Typical current street price, $180.

The Diamond GZV4000

The GZV4000 is taller, wider and deeper than the other switching supplies that we've considered so far and, at 40 A, it also carries the largest continuous current rating of the switching supplies that we've tested.

Its grand dimensions and stylish dark gray molded plastic front panel give it a look that nicely compliments the enclosures of several current amateur HF transceivers.

Through the years, many of the individual radio manufacturers have offered "matching" power supplies, "matching" external speakers—and additional accessories as well—that exhibit design elements and colors that blend perfectly with their own line of HF transceivers. Although same-brand "matching" accessories usually cost considerably more than suitable aftermarket alternatives—amateurs of means will often pay the premium to achieve that three-foot wide, perfectly integrated, station appearance.

While the style and color of the GZV4000 is not an *exact* match for any of the current radios, it has a generic look that is more than attractive enough to earn it a place of honor next to the main transceiver even in the most aesthetically fastidious ham's operating position.

The front panel has a rocker style **POWER** switch, LED **AC POWER** and **OVERLOAD** indicators, a voltage control knob, a large backlit voltage/current meter, a slide switch to select the meter function and a front-firing built-in speaker. A flip-down door centered on the lower edge of the front panel conceals a cigarette lighter socket that can supply up to 10 A and a set of snap-in terminals rated for up to 6 A.

The dc output voltage can be varied between 5 and 15 V dc. A detent in the midpoint of the travel of the **VOLTAGE** control corresponds to 13.8 V.

The rear panel includes a pair of large widely-spaced binding posts for connecting high current loads, a 3.5 mm jack that delivers external audio to the built-in speaker, a fuse for ac line protection, a station ground connection point and a per-

Table 3
Diamond GZV4000
serial number 00400788

Manufacturer's specifications
Power requirement: 120 V ac.
Output voltage: 5.0-15.0 V dc.
Output current (continuous): 40 A.
Size (hwd): 4.3×8.3×11.8 inches;
weight, 6.6 pounds.

Lab Measurements
Output voltage, no load: 13.77 V dc.
Output voltage, 21 A load: 13.70 V dc.
Low line drop out voltage: 84 V ac.
Dc variation during dynamic testing:
≈50 mV.

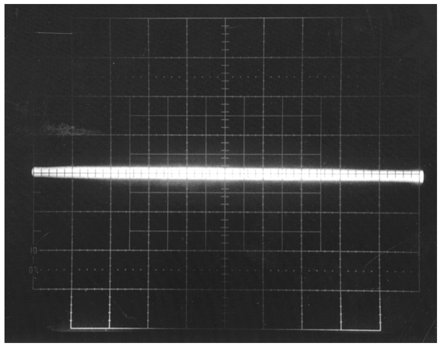


Figure 6—An oscilloscope trace of the dc output of the Diamond GZV4000 while operating under a 20 A load. The vertical scale is 5 mV/div and the horizontal scale is 5 mS/div. The level of dc ripple is very low, approximately 1 mV p-p, and there are no discernable spikes.

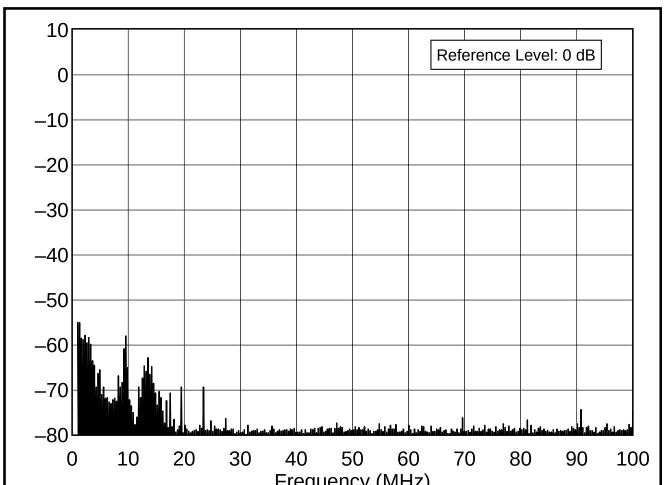


Figure 7—A spectral plot of the output of the Diamond GZV4000 under load. This supply exhibited moderate levels of broadband noise within some portions of the US amateur bands, primarily below 4 MHz and near 14 MHz.

manently affixed 120 V ac power cord. Provisions for operating this supply from a 220 V ac source are not included, but the documentation does seem to indicate that a separate 220 V model is manufactured. Automatic protection circuitry—for overload and excessive temperature—is included.

The *Instruction Manual* that comes packed with the supply consists of a single folded $8^{1}/_{4} \times 11^{3}/_{4}$-inch sheet with a list of features; a specifications table; connection and control descriptions; installation and operating instructions; and a handful of safety precautions. A schematic diagram is not included.

As is the case with the MFJ-4225MV that we looked at back in January and the Alinco DM-330MV, the GZV4000's variable voltage capability and front-panel lighter socket and terminals make it a good choice if you occasionally need a dc supply for test bench applications. The flip-down access door and rear panel mounted high current connection points help it retain its good looks during typical station supply use.

The large temperature-controlled cooling fan, mounted in the rear panel of the enclosure, runs continuously when the power is on. The fan speed increases if the temperature exceeds a preset level. The amount of fan noise under typical conditions is low to moderate—about equivalent to that of the typical desktop PC's supply fan.

The inclusion of a built in speaker was a pleasant surprise. While the speaker itself is smaller than most that are provided within the enclosures of the current HF transceivers, the sound quality is pretty good. Its front firing design directs receiver audio towards the operating position better than the usual top-cover mounted speakers, but it is no competition for the audio quality improvement that results from the larger magnets and cones found in most "matching" and aftermarket external speakers.

The GZV4000 was substituted for the conventional transformer-based supplies in several typical HF station configurations. No noticeable increase in broadband noise or spurious signals within the tuning range of the connected transceivers, or changes in the quality of the transmitted signals, were observed.

The supply was used to power a load that is roughly equivalent to that of a 100 W HF transceiver operating at 100% transmit duty cycle (21 A at 13.8 V dc) for 30 minutes. The case temperature of the supply increased only slightly. The large fan and generously vented enclosure, and the fact that the supply was only running at approximately half of its current capacity, may give it a bit of an unfair advantage in this particular exercise. Let's bear in mind, however, that for our typical purposes—supplying dc power for a 100 W HF transceiver—this test probably adequately approximates real-world amateur station applications.

If you are enamored by the look of a matching power supply, but are also interested in such niceties as front panel metering, higher current supplying capabilities, conveniently located low- to mid-current connection points and variable dc output for test bench applications (…and perhaps wouldn't mind saving a bit of cash in the bargain), be sure to check out the Diamond GZV4000.

Manufacturer: Diamond Antenna division, Dai-ichi Denpa Kogyo Co, Ltd.

Manufacturer's US representative: RF Parts, 435 S Pacific St, San Marcos, CA 92069; 800-737-2787; fax 888-744-1943; **rfp@rfparts.com**; **http://www.rfparts.com/diamond**.

Suggested list price, $229.95. Typical current street price, $190.

A Few Observations

Looking over the Lab data presented in Tables 2 and 3; the oscilloscope traces of the dc outputs in Figures 4 and 6; and the spectrum analyzer plots in Figures 5 and 7, and comparing these with the corresponding data that we published in the previous switching supply review, reveals that this review's subjects perform very well.

The oscilloscope traces, unlike some of those in the earlier review, are virtually flat. No evidence of high frequency spikes was seen on the outputs of either supply.

The spectral plots of the supplies operating under a 20 A load (simulating a transmit condition), while perhaps not quite as clean in some of the lower frequency ranges as those of the Astron or MFJ supplies that we investigated in January, still indicate better than average performance.

During field testing, neither of these supplies generated any perceivable interference in any of the station receivers. Transmit quality was also unchanged when these switching supplies were substituted for conventional supplies.

As we stated in the previous review, there are a few instances where the level of broadband RF noise generated by a switching supply under load could create interference problems. Multi-radio operations where several transceivers are set up in close proximity, contest stations where a second receiver is sharing the same supply with a transceiver or "mode A" full duplex satellite operation are some possible examples.

For most casual fixed station, portable and test bench applications though, nearly any of the switching power supplies that we've looked at so far should provide very acceptable performance.

EZNEC 3.0 for *Windows*

By Michael Tracy, KC1SX, ARRL Laboratory Engineer

Lots of hams like to "fiddle" with antennas, and antenna modeling software can make the task easier and more fun.

Until recently, most antenna modeling software for the PC was *DOS*-based. While *DOS* software can run under *Windows 95* and *98*, these older programs can present a bit of a challenge to folks who got started on *Windows 95/98* systems. Also, *DOS* software runs in a single window only, missing out on one of the real advantages of the *Windows* environment.

Getting Started

Those who already have one of W7EL's *DOS* programs will have a short learning curve on *EZNEC 3.0.* For new users, the help information includes an excellent "walk-though" type tutorial that covers basic operation and advanced features, some practical examples and a demonstration of features particular to this new *Windows* version.

The first major change in *3.0* is the on-line manual in the help system. I initially thought that I'd want to print out the parts I needed to refer to, but since the help is very well organized, and the window can be left open for handy reference, I found that I didn't miss "the book" all that much.

What *DOS* users will notice immediately is the change in appearance of the main window. Instead of two-letter command keys, there are 10 "action buttons" on the extreme left and 14 "selection" buttons along the left edge of the antenna information portion (the selection button can change as needed, much like "soft key" menus in certain transceivers).

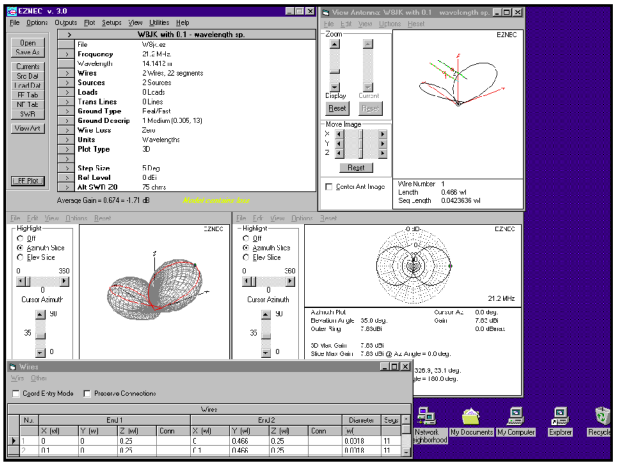
Wires, Wires

The antenna configuration is edited by edited by clicking on the **WIRES** selection button. The wires window looks somewhat like a simple database table. Each row defines a wire, with columns for end coordinates, end connection points (if any), wire diameter and the number of "segments" (the number of chunks to split the wire into for analysis). One of the special new features is included here. If you position the mouse cursor over one of the coordinate columns and click the right mouse button, you'll see a pop-up menu that lets you change the coordinate (relative), change the length (relative or absolute), rotate the end (in azimuth or elevation) or connect that end to the end of another wire.

A word about wires. If you haven't used antenna modeling software before, you might be thinking that you can only model wire antennas—not so! The term "wire" here only refers to the representation of the antenna as multiple straight conductors. You can set the wire diameter to several inches if you like and aluminum conductors can be modeled as well. The program includes a "wire loss" selection button that lets you choose aluminum, copper, tin and zinc (useful for galvanized steel). You can also choose "zero" if you can neglect wire loss in your model and you can also define the loss if you know the resistivity and relative permeability of your material of choice.

Other helpful windows version features involve the "View Antenna" window (activated by an action button on the main screen). If you have this window open at the same time as the wires window, and you make a change to a wire, you will get an immediate update on what the changed antenna looks like. This is especially handy when you are rotating wire ends and accidentally go the wrong way!

If you have diagonal wires that you need to check the length of, just position the mouse cursor near the wire and hold the right mouse button down—you'll see a small text box showing the wire number, wire length and segment length.



You can also alter your perspective of the antenna in this window. Zoom in (or out), slew in all three axes and rotate the graphic. Moving around like this makes checking complex designs (like a 5-element quad) a snap!

Frequency can be changed via one of the action buttons and you also have the option of automatically re-scaling the antenna dimensions by the amount of the frequency change. You can use this feature to modify the model for another band or simply shift the size slightly for a better SWR.

Pattern Potting

Of course, the pattern plot is what we're most interested in, right? Well, *EZNEC 3.0* shines here, too. Like the *DOS* version, you can plot azimuth or elevation patterns in "2D," or plot the complete pattern in three dimensions as a wire frame structure. If you have 800 × 600 screen resolution or better, you can view both the plots and the antenna window all at the same time. The 2D pattern also shows up on the view antenna window so you can see where the major lobes are relative to your wires.

More Features

The SWR action button tells you the SWR (relative to the Z0 chosen) of the model, giving you a graph over a frequency range (you choose frequency limits and step).

The **Src Dat** action button computes the electrical characteristics at the antenna Source (feed point), including impedance in rectangular form (ie, "47 -*j*5.6") and SWR at the design frequency. **Load Dat** performs a similar function for antenna loads (if any). **FF Plot** is the button that creates the far field pattern. **FF Tab** produces a tabular output of the pattern instead of a graph. **NF Tab** does the same for the near field, which can help you evaluate the RF safety of the antenna if you know how to interpret the data and set up the model. The Currents action button gives a table of the current magnitude and phase in each of wire segments.

Although the program is easy to get started with, it takes some "tinkering" to discover the nuances of all its features. But for those who love experimenting with antennas, it's a lot of fun and eye-opening, too.

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