Product Review Column from *QST* Magazine

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A *QST* Roundup: Three Legal-Limit Linear Amplifiers
(Alpha/Power 91B; Ameritron AL-800H; QRO HF-2500DX)

Raibeam RB-206B Two-Element 6 Meter Beam

Timewave DSP-59Y Audio Noise Reduction Filter

Product Review

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

A *QST* Roundup: Three Legal-Limit Linear Amplifiers

By Rick Lindquist, N1RL
Senior Assistant Technical Editor

As the fall contest season approaches, some hams' fancy undoubtedly will shift from sun-filled days on the beach to linear amplifiers to complement that new contest machine (*anything* but raking leaves). Or, maybe they're looking to replace Ol' Betsey (you know, the beat up green cabinet with a pair of 3-500Zs) with something a bit newer, more rugged or reliable, or that includes 160 meters. Although most primarily contest stations want an amp that will consistently and reliably run the legal limit for two days without dropping dead of fatigue or heat stroke, there are other characteristics worthy of consideration. Does the amp "run hot?" Is it noisy? Can you tune it quickly and easily? Are the tubes expensive to replace?

Uncompromising hams with a need for power and a budget to match might be willing to spend several thousand dollars for what they consider the "right" amplifier—maybe one of those pricey solid-state "no-tune" jobs. But hams of more modest means still want to get the most bang for their buck, so, if your budget does not recognize the expression, "the sky's the limit," then you might find one of the three legal-limit linears in this roundup the ideal choice for your situation.

In this review, we'll look at the Alpha/Power (formerly ETO) 91β (pronounced as "beta" or just plain B), the Ameritron AL-800H, and the QRO Technologies HF-2500DX amplifiers. All of these amps are manually tuned, have two ceramic output tubes and offer the legal maximum of 1500 W PEP on all modes and bands from 160 to 10 meters. Each will cost you about the same as the transceiver you drive it with. All of these amplifiers come from the factory with 10 and 12 meter operation disabled. Typically, modification information simply requires proof that you hold a valid Amateur Radio license.

Although some of these amplifiers can be configured to operate on supply voltages as low as 90 V ac, we tested all three units at the manufacturer's recommended supply voltage of 240 V.

ALPHA/POWER 91β

Although it's not immediately obvious from looking at the outside package, the 91β has an international flair (it's also the amplifier that went along on the VKØIR DXpedition earlier this year). The amplifier's 4CX800A tetrodes (actually, military-type GU74Bs) are made in the Svetlana plant in Russia; ICs, FETs, some diodes, the blower motors, and some other parts are manufactured in the US. Several parts, including the band switch, are made in Bulgaria, where the amps are assembled. For all intents and purposes, the 91β is an economy-model ETO Alpha 89 (see "Product Review," *QST*, Jul 1994). The 91β has the same blower used in the ETO Alpha 87 and 89. (The Bulgarian plant supplies a separate blower housing for the European and Far Eastern markets). Like the 89, the 91β has bargraphs for RF output, reflected power and tuning (this one can also mea-

Table 1
Legal-Limit Linear Amplifier Features

	Alpha/Power 91β	Ameritron AL-800H	QRO HF-2500DX
Tube type (class)	4CX800A/GU74B (AB_1)	3CX800A7 (AB_2)	4CX800A (AB_1)
Circuit configuration	Grid-driven tetrodes	Grounded-grid triodes	Grid-driven tetrodes
Built-in wattmeter	Yes (LED bargraph)	Yes (cross-needle meter)	No
Full break-in (QSK)	Yes	Option	Yes
Grid overcurrent protection	Yes	Yes	No
Screen overcurrent protection	Yes	n/a	Yes
Plate overcurrent protection	Yes	No	No
High SWR protection	Yes	No	No
High temperature protection	Yes	Yes	No
Arcing protection	Yes	No	No
Mistuning protection	Yes	No	No
120 V operation	Yes	Yes	No
Standard warranty	Four years*	One year*	Two years*
Suggested retail price	$2798	$2295	$2895

*Tubes are covered under a separate manufacturer's warranty.

Expanded Product Review Report Available

The ARRL Lab offers an expanded test result report on the three legal-limit linear amplifiers we reviewed: the ALPHA/POWER 91β, the Ameritron AL-800H, and the QRO HF-2500DX. The report will provide in-depth, detailed technical data on the amplifiers' performance, outlines our test methods and helps you to interpret the numbers. The report will include full-power spectral purity charts for each band and a chart showing how it stacks up against similar, previously reviewed units.

Reports are $7.50 for ARRL members and $12.50 for nonmembers, postpaid. Personal checks are accepted. Request the *Legal-Limit Linears Roundup Test Report* from the ARRL Technical Department, 225 Main St, Newington, CT 06111. For credit card orders only, call 860-594-0278.

Table 2
Alpha/Power 91β, serial number 961610296

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: (US units) All amateur frequencies, 1.8 to 14.35 MHz.*	As specified.
Power output: 1500 W peak, all modes, including SSB, CW and continuous or modulated carrier.†	As specified for SSB and CW.
Driving power required: Not specified.	45 to 80 W (depending on band) for rated output.
Input SWR: Not specified.	Less than 1.5:1.
Spurious signal and harmonic suppression: 55 dB or greater.	52 dB, worst case (3.5 and 7 MHz).
Intermodulation distortion (IMD): –36 dB.	See Figure 1.

Primary power requirements: 100, 120, 200, 220, 240 V ac (user settable) at up to 20 A.
Size (HWD): $7^1/_2 \times 17 \times 15^1/_2$ in; weight: 66 lb.

*As shipped from the factory, operation on 15, 12 and 10 meters is disabled. Appropriately licensed users may contact ALPHA/POWER for information on how to modify the amplifier to extend coverage to 29.7 MHz. Specified coverage includes "extensive out-of-band capability" for operation on MARS frequencies.

†Optional auxiliary cooling fan recommended for extended high-duty-cycle operation.

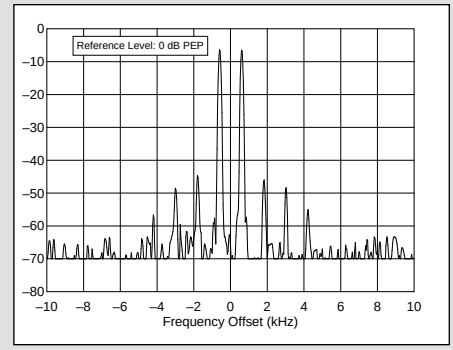

Figure 1—Spectral display of the ALPHA/POWER 91β during two-tone intermodulation distortion (IMD) testing on 14 MHz at 1500 W PEP output. The third-order product is approximately 45 dB below PEP output, and the fifth-order product is down approximately 49 dB.

sure plate voltage or plate current). In addition, the 91β has LEDs to indicate minimum and maximum grid current. These LEDs use simple "traffic light" logic—green if you're within normal (ie, safe and legal) operating parameters and red if you exceed them. The absence of the more pinpoint accuracy of meters was not an issue with any of those who used this amplifier.

Front-panel controls are basic. It has a seven-position **BAND-MHZ** switch (18 and 21 share one position, while 24 and 28 share another). The direct-drive (ie, nonvernier) **TUNE** and **LOAD** controls have 0-100 logging scales marked on the panel. There's a switch to select the readout function of the multifunction LED bargraph. You can choose from among **HV** (in kV), **IP** (in A) or **TUNE** (a **V** marks the spot on the bargraph). Rocker switches for **OPR/STBY** and **ON/OFF** round out the complement of front panel controls.

As you'd expect, this amp is no lightweight. Handles or another means of getting a better grip on the box itself would have been a welcome addition. The 3 kVA strip-wound transformer (made in Bulgaria) comprises approximately one-half of the unit's weight. The amplifier arrives in two cartons; one for the transformer and another for the RF deck. Installing the transformer is quite simple and straightforward; the transformer even has a convenient little handle on it. Transformer wiring is all via plug-in connectors.

The most prominent feature on the rear panel is the large cooling fan intake screen. There are also four fuse holders, phono jacks for **RELAY**, **KEY OUT** and **ALC**, an **ALC ADJ** trimpot, SO-239s for **RF INPUT** and **RF OUTPUT** and a wing nut on a stud for the **GND** connection. The 91β comes from the factory wired for 240 V ac. You'll want to leave it that way for best results, although it can be wired to run at reduced output power on as little as 90 V ac.

The 4CX800A (GU74B) ceramic-metal tetrodes operate in Class AB_1. The input is loaded by a non-inductive 50-Ω resistor, and an L/C matching network compensates for reactances on the higher bands. You will not need to run your transceiver at full-tilt boogie to max out the 91β. We found that as little as 25 or 30 W would result in 1000 W output, so your transceiver can loaf. An electronic bias control system senses RF drive and reduces plate current to 30-50 mA during pauses in speech or key-up intervals.

Full-break-in (QSK) is standard with the Alpha/Power 91β. Enabling the rear-panel **RELAY** jack requires the ability to switch (or sink) 12 V dc at 10 mA.

The *User's Manual* contains all the information you'll need to get the 91β up and running. It includes several illustrations and photographs, troubleshooting hints, a table of preliminary tune-up settings, and complete schematics of all assemblies and subassemblies.

The 91β uses a pi-**L** output circuit (the **L** coil is a toroidal inductor), and Alpha/Power switches additional capacitance in or out as required. In addition, the plate RF choke is switched according to band, to optimize performance.

To thwart all but perhaps the most deter-

mined efforts to destroy the tubes (and to permit Alpha/Power to offer a four-year warranty), the 91β contains a plethora of protective circuits. Alpha/Power says the amp constantly measures its own gain and will fault if the gain differs from the nominal 13 to 15 dB. This system is at the heart of all of the 91β's fault-protection circuitry. For example, if the amplifier senses more than 250 W reflected power, it automatically switches to standby and the **FAULT** LED will come on. There's arc and mistuning protection, too. If the protective circuitry senses the start of an RF arc in a capacitor, for instance, the unit faults ("within a few milliseconds," according to Alpha/Power). The system even protects against mistuning! The fault-detection system also includes grid current limiting, screen current foldback, and sustained overdrive trip circuitry.

In addition, the 91β has a plate overcurrent relay that shuts down the amplifier in the case of "grossly excessive plate current" (although this might not prevent tube damage, per se), plus a high-voltage crowbar circuit. ALC is available, if desired. Alpha/Power recommends purchasing the optional auxiliary (transformer) cooling fan if you plan to use the amp for *continuous* key-down carrier operation for periods exceeding five minutes.

Our 91β worked fine once Alpha/Power determined that a suspected problem that showed up in our early testing was a fluke. An interim 91β loaned by Alpha/Power did not fare as well. During a contest, it suffered a component failure in the screen supply.

Otherwise, we found the 91β to be a real workhorse that will just chug along at 1500 W output for hours on end (one tester called it the "Energizer amplifier"). It runs fairly quietly too. One issue arose over the LED logic. With the amp in standby mode, there's no front-panel indication (until you try to actually operate) that the amp has sufficiently warmed up. A couple of ops at first thought the tuning was a bit on the "fussy" side, but we found that once you get the tuning procedure down pat (the *User's Manual* outlines 11 steps), it's pretty simple, and you should be able to switch bands fairly quickly.

Manufacturer: Alpha/Power Inc, 14440 Mead Ct, Unit B, Longmont, CO 80504; tel 970-535-4173; fax 970-535-0281. Manufacturer's suggested retail price: $2498.

AMERITRON AL-800H

For a full-legal-limit amplifier, the AL-800H is quite compact. The AL-800H uses a pair of Eimac 3CX800A7 ceramic triodes operating Class AB_2 in a "traditional" grounded-grid configuration. The package comes in a handsome, neatly finished black box that's easy to fit in most shacks—or to move from place to place, if you should need to.

The front panel of the AL-800H features two cross-needle type meters set side by side. The left-hand meter simultaneously reads grid current and plate current, while the right-hand multimeter indicates SWR (forward and reflected power), high voltage, and ALC. The vernier driven **PLATE** and **LOAD** knobs have 0-100 logging scales and red pointers. The **BAND** switch has positions for 160, 80, 40, 20/30, 15/17 and AUX. The front panel controls also include a **MULTIMETER** switch, an **ALC SET** knob,

Table 3
Ameritron AL-800H, serial number 00038

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: (US units) All amateur frequencies, 1.8 to 21 MHz.*	As specified.
Power output: 1500 W CW, SSB; 1000 W continuous carrier (up to 30 mins).	As specified for SSB and CW.
Driving power required: 55 W typical.	41 to 61 W (depending on band) for rated output.
Input SWR: 1.3:1 or less (max).	As specified.
Spurious signal and harmonic suppression: Not specified.	50 dB, worst case (29 MHz).
Intermodulation distortion (IMD): –35 dB.	See Figure 2.
Primary power requirements: 240 V ac at 14 A (for rated CW output).	
Size (HWD): $8^1/_2 \times 14^1/_2 \times 17^1/_4$ in; weight: 52 lb.	

*As shipped from the factory, operation on 12 and 10 meters is disabled. The AL-800H can be modified for operation above 15 meters. Instructions are available by written request, which should include a copy of the owner's valid Amateur Radio license.

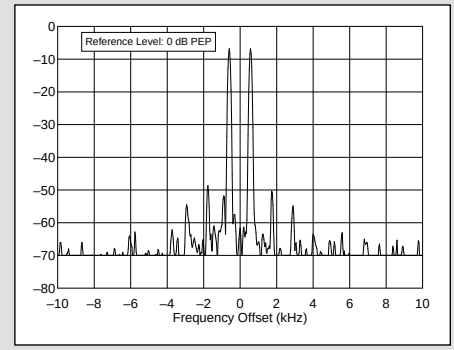

Figure 2—Spectral display of the Ameritron AL-800H during two-tone intermodulation distortion (IMD) testing on 14 MHz at 1500 W PEP output. The third-order product is approximately 49 dB below PEP output, and the fifth-order product is down approximately 55 dB.

and **ON/OFF** and **OPR/STBY** rocker switches. A red **OL** LED indicates a thermal overload, while a green **XMT** LED indicates the unit is in transmit mode.

The rear panel includes SO-239 connections for **RF IN** and **RF OUT**, plus phono jacks for **RLY** and **ALC**, a 12V connection to provide 12 V dc at 200 mA for external equipment and a **GND** terminal. Your transceiver will need to handle 12 V dc at 100 mA to activate the AL-800H's relay.

The AL-800H comes from the factory with the transformer already installed. However, the tubes are packed inside the amplifier box for shipping, and the user must install the tubes and the chimneys. The unit is wired for 240 V ac operation. While the AL-800H can be wired to accommodate a variety of supply voltages down to 90 V ac, the manufacturer does not recommend operating it on supply voltages below 200 V.

To protect the tubes, the AL-800H features a grid overload circuit that disables the amplifier if the grid current rises excessively and a thermal overload that automatically shuts down the amp if the transformer gets too hot (there's a sensor in the transformer). The automatic level control (ALC) circuit samples grid current and power supply loading to compute the ALC voltage. A front-panel **ALC SET** knob lets the user determine where ALC action starts. The AL-800H also incorporates what Ameritron calls a "dynamic bias" circuit that automatically adjusts idling current to the tubes in accordance with RF drive.

Because this is a grounded-grid amp, the AL-800H includes tuned input circuits for each bandswitch position to optimize power transfer between the transceiver and the amplifier. The plate tank circuit is a pi-**L** circuit with two plate tank coils (low frequency and high frequency) and a toroidal **L**-coil.

While full break-in CW operation (QSK) is not standard on the AL-800H, the optional QSK-5 stand-alone PIN diode switch or the internal QSK-5PC board will provide high-speed receive-transmit switching.

The *Instruction Manual* that comes with the AL-800H includes circuit diagrams and parts lists for all assemblies, as well as a description of the amplifier, detailed tuneup instructions (13 steps in all) and other information. Tuning instructions include a chart of suggested settings by band for both CW and SSB operation, plus a chart to log actual settings for most-used frequencies. The manual is clear and concise. Aside from the schematics, it includes no photographs, diagrams or illustrations.

Late in our review process, we discovered that our AL-800H had developed a problem that caused intermodulation distortion (IMD) products that did not seem reasonable for an amplifier of this design. Apparently a problem cropped up late in the game, as our earlier tests on this amplifier were nominal. While Ameritron did not have an opportunity to determine what went wrong with our amplifier, they did supply us with a similar unit for follow-up IMD testing. The ARRL Lab considers these measurements, shown in Figure 2, to be representative of a properly functioning AL-800H.

In actual use, we found the AL-800H reasonably easy to tune up and operate. When you first turn it on, the multimeter lamp does not illuminate until the amp is ready to use (at first, we thought it was a blown lamp). The built-in wattmeter is reasonably accurate, too—typically within 10% and most times right on the money. The AL-800H operated reliably during extended SSB contest use as well as in more casual operation and only griped when misused.

Manufacturer: Ameritron, 116 Willow Rd, Starkville, MS 39759; tel 601-323-8211; fax 601-323-6551. Manufacturer's suggested retail price: $2295. QSK-5 or QSK-5PC board, $349.

QRO TECHNOLOGIES HF-2500DX

If you like large, heavy metal equipment built with lots of margin, you'll love the HF-2500DX. There's nothing delicate about this amplifier. What it might lack in stylishness it makes up for in brute force. The amp is housed in a large, gray aluminum cabinet that, once you set it down, you'd like to see it stay put (it weighs 90 lb). Like the Alpha/Power 91β, the HF-2500DX uses two Svetlana 4CX800A tetrodes, in this case operating in Class AB_1.

The HF-2500DX arrives from the factory not in one or two cartons but in *three* cartons—tubes and control transformer in one, plate transformer (a Peter Dahl 3kVA unit) in another, and the RF deck in the third. The transformers install easily into the RF deck. All connections snap together. As expected, the unit comes wired for 220 to 240 V ac operation. By changing jumpers, it can be set to operate at 200 V ac.

The broad, vinyl-covered front panel features two very utilitarian looking meters, **SCREEN** and **MULTIMETER**. The **SCREEN** meter reads screen current continuously, while the **MULTIMETER** can be switched to read plate voltage, plate current or screen voltage. Users of the HF-2500DX felt that QRO also should have included a wattmeter.

The front-panel **BAND** switch has a very husky feel to it (it's a Radio Switch model 96 ceramic bandswitch with 25 A contacts). It has positions for 160, 80, 40, 20, 15 and 10 meters. The 17 meter band shares the 15 meter position, and the 12 meter band shares the 10 meter position on the **BAND** switch. Vernier knobs with little crank handles are provided for **TUNE** and **LOAD**. The black pointers cover 0-100 logging scales. The crank handles are a nice touch and speed up the tuning process. There's also a big red **FAULT** lamp/switch that comes on when something's gone awry (and lets you reset the amp by pushing it), plus an **ALC ADJUST** knob (with a 0-10 logging scale) and three big rocker switches: **FAN HIGH/FAN LOW**, **OPERATE/STANDBY** and **ON/OFF**. Protective circuitry trips the amplifier when the screen current is too high.

The rear panel provides SO-239 connectors for **RF IN** and **RF OUT**, plus phono jacks for **ALC OUTPUT** and **KEY XMT** (and **+15 V XMT** input (for transceivers that can provide 12-15 V dc for T/R switching; this requires factory activation before shipment, however). The HF-2500DX is equipped for full break-in (QSK) on CW. Your transceiver must be able to switch (or sink) 11 V dc at 80 mA to enable the **KEY XMT** jack.

The HF-2500DX can provide 1500 W peak in all modes, including SSB, CW and continuous or modulated carrier modes like RTTY, FM or SSTV. However, the manufacturer cautions against full-power operation longer than 30 minutes in continuous or near-continuous-duty modes without auxiliary cooling. The cooling fan provides 50 CFM of air flow through the amplifier in its high setting.

This grid-driven amplifier has a 50 Ω noninductive shunt (or swamping) resistor on the input side to present a nominal load to the exciter. On bands above 40 meters, circuitry ahead of the swamping resistor compensates for the capacitive reactance presented by the tubes. The output tank circuit is a pi-**L** type. Additional capacitances are switched in to supplement the variable capacitors on 80 and 160 meters. The **L** coil is a toroidal type with taps.

During ARRL Lab testing, our HF-2500DX initially failed to meet spectral purity requirements for equipment in this power class on the bands below 20 meters. We sent our unit back to QRO Technologies. QRO's Ray Connin, KB8VU, determined the problem centered on the 4:1 output transformer that had been used in the tank circuit (Connin believes his company got some bad core material for the toroids). QRO replaced our original amplifier with one that was modified to use the three-stage **L**-coil, which QRO plans to implement as a permanent change in future production. Testing of the second unit in the ARRL Lab indicated the amp met or exceeded spectral purity requirements.

The *Instruction Manual,* enclosed in a rugged plastic binder, is quite comprehensive. It contains some photographs and illustrations to guide the user, as well as a set of complete schematic diagrams. At one point, QRO has recorded the actual test settings and readings. The outlined tune-up procedure appears aimed at making sure you don't exceed the screen current limitations. Rather than tune for "maximum smoke" (as most grounded-grid amplifier owners often do), you keep tuning between a maximum and minimum screen current level until you reach full output power. Tuning up this amp takes a little getting used to at first, but it's easier over time. Recording the settings for later

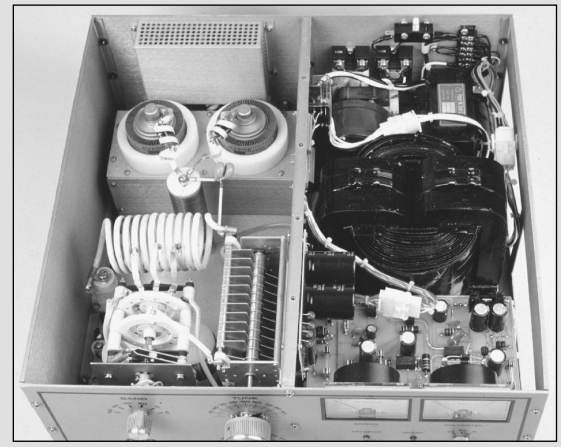

Table 4

QRO Technololgies HF-2500DX, serial number 5450

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 160, 80, 40, 20, 17, 15, 12 and 10 meters*	As specified.
Power output: 1500 W peak, all modes, including SSB and CW, and continuous or modulated carrier.†	As specified for SSB and CW.
Driving power required: 50 to 60 W nominal.	40 to 80 W (depending on band) for rated output.
Input SWR: 1.5:1 or less.	As specified.
Spurious signal and harmonic suppression: 45 dB.	46 dB, worst case (3.5 MHz).
Intermodulation distortion (IMD): Not specified.	See Figure 3.

Primary power requirements: 200 or 240 V ac at up to 25 A.
Size (HWD) 8×20×19 in; weight: 90 lb.

*As shipped from the factory, operation on 12 and 10 meters is disabled. Appropriately licensed users may contact QRO Technologies for information on how to modify the amplifier to extend coverage to 29.7 MHz.

†Optional auxiliary cooling fan recommended for extended high-duty-cycle operation.

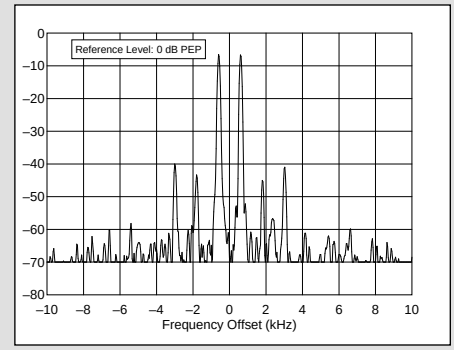

Figure 3—Spectral display of the QRO HF-2500DX during two-tone intermodulation distortion (IMD) testing on 14 MHz at 1500 W PEP output. The third-order product is approximately 43 dB below PEP output, and the fifth-order product is down approximately 40 dB.

use will preserve your patience.

In real-world operation, the HF-2500DX provided almost flawless performance during contesting and noncontesting operation (in fact, it was invited back to one well-known contester's QTH for an encore performance). For the most part, it just hummed right along, although at one point (on 40 meters), it balked (by arcing internally) when faced with a 2:1 SWR situation at full power. It worked okay at 1000 W, however. The biggest complaints involved the unit's size and weight. Consensus was that the manufacturer should either provide carrying handles or design the unit with enough clearance around the bottom edge that it doesn't crush your fingers when you set it down (taller feet would do it cheaply.)

Manufacturer: QRO Technologies Inc, 1117 W High St, Box 939, Bryan, OH 43506; tel 419-636-2721; fax 419-636-6039; e-mail **qrotec@bright.net**; **http://www.bright.net/~qrotec**. Manufacturer's suggested retail price: $2895.

Many thanks to Peter Budnik, KB1HY; Glenn Swanson, KB1GW; Tom Frenaye, K1KI; Dave Sumner, K1ZZ; and Mike Tracy, KC1SX, and Ed Hare, W1RFI, of the ARRL Lab, for their contributions to this review.

Raibeam RB-206B Two-Element 6 Meter Beam

Reviewed By Bart J. Jahnke, W9JJ
ARRL/VEC Manager

With the ever-increasing popularity of the 6 meter band—and especially since 6 meters has been added to many HF transceivers—what else do you need in addition to a 6 meter transceiver? Why a 6 meter antenna, of course.

For years, amateur antenna manufacturers have marketed multi-element Yagi antennas for our lowest VHF band. What has been in shorter supply, however, are smaller—but performance-rich—antennas such as this two-element Raibeam Yagi.

Description

The Raibeam RB-206B is a two-element HB9CV-type antenna.[1] In that design, two dipole elements are driven out of phase with respect to each other and closely spaced. Elements that resonate on the same frequency yield a bidirectional pattern. In the case of the HB9CV or the Raibeam, one element is longer than the other—as on a typical parasitic (Yagi) array—and the phasing is such that the antenna has a unidirectional pattern in the direction of the shorter element. The different element size also increases the bandwidth and is part of the mix necessary to get a favorable front-to-back (F/B) ratio. The manufacturer claims a F/B of 25 dB or greater and an SWR bandwidth of about 400 kHz for a SWR of 2:1 or less.

Computer modeling of this design shows that a beam like this will have the same gain but better F/B ratio than a Yagi on the same boom length.

At 3 pounds, this is a very light antenna, with a turning radius of slightly more than 10 feet. It's easily turned by any small TV-type rotator and can fit within just about any backyard (or attic) or on just about any roof. This antenna is also small enough to be partially disassembled and backpacked to your favorite hill or mountaintop, or for temporary installation at your favorite portable location, car, boat—you name it!

The antenna is designed primarily to be mounted for horizontal polarization and used at the recommended construction dimensions for SSB/CW on the low end of the 6 meter band (ie, 50.0 to 50.4 MHz). The manufacturer recommends against trying to alter the antenna's dimensions to make it usable at higher frequencies, say for FM operation in the 51 to 54 MHz portion of the band. This is because changing the antenna's operating frequency range would require altering the dimensions of the phasing harness as well as those of the elements, and this could affect overall performance

The RB-206B comes with a standard SO-239 female UHF connector to handle the feed line attachment. The antenna-to-mast clamps accept mast diameters of 1 to $1^{3}/_{4}$ inches. This antenna is constructed primarily of lightweight aluminum tubing. Machined aluminum blocks are used for element-to-boom mounting (the manufacturer obviously took care to maintain a high degree of quality in these and most other parts of the antenna). While I inadvertently subjected my antenna to bumps, twists, snags and pokes as I handled, assembled and mounted the antenna, no detectable damage was apparent.

Table 5
Raibeam RB-206B Manufacturer's Specifications

Maximum element length	9 ft 10 in
Boom length	2 ft 1.25 in
Turning radius	10.125 ft
Weight	3 lb
Wind loading area	0.75 ft^2
2:1 SWR bandwidth	400 kHz (50.0 to 50.4 MHz)

Assembly, Instructions and Installation

The Raibeam RB-206B antenna comes with a six-page assembly manual. Step-by-step instructions and pictorials are provided for ease of assembly. The manual includes a parts reference list, and my antenna included a packing list checked and initialed by the packer of the box (I was impressed to see this sheet and the personal, original check marks and signature of the packer). Once I compared the parts list against the contents of the box, I was off to assemble the antenna.

With small antennas, I choose to assemble them indoors. With an element length of less than 10 feet and a two-foot boom, you can easily march the assembled antenna right out the door.

Common wrenches (or a nut driver set) and a screwdriver were all the tools needed to assemble this antenna. An Allen set screw holds the element-to-boom blocks in place, and the manufacturer conveniently provides the necessary wrench. Raibeam also included a package of metal contact compound—a grayish grease that inhibits oxidation between abutting metallic surfaces.

Assembly was straightforward. After putting together the antenna's boom and element-to-boom brackets, matching and feed system, and finally the two elements, I made sure to align and tighten down all brackets, screws and bolts. You must align the elements with each other and tighten the small boom-to-element bracket and Allen set screws. Before mounting my antenna to the mast, I failed to tighten the Allen screws tight enough, and the elements rotated (with some effort) on my boom. Fortunately, owing to the short boom, I was able to quickly realign the elements and—with slightly more effort but still within arm's reach—tighten down the Allen screws very snugly. After you get the antenna up on a temporary mast, you can tighten down the boom to mast bracket and set the antenna horizontal or vertica,l as desired.

After you assemble the antenna and set the element lengths as recommended or desired, it's time for the SWR check. Connect a quality, low-loss feed line to the antenna, then temporarily mount the antenna 10 feet or so above the ground. Apply a small amount of RF to the antenna at the desired frequency and check the SWR. I found it to be 1.2:1 or better at 50.125 MHz using the manufacturer's recommended dimensions.

Installing this or any other antenna should be done with care and caution. Always watch for nearby power lines and obstacles when raising your antenna to its desired mounting spot. Once the antenna is mounted, attach a good low-loss coaxial feed line. While Belden 9913 or equivalent feed line is better at this frequency range, RG-8 foam-type coax also should suffice. To suppress feed line radiation, the manufacturer recommends wrapping the coaxial feed line into three or four loops (8 inch diameter coil) and taping it to the boom—suspending it vertically at the boom-to-mast mount.

BOTTOM LINE

This small 6 meter antenna fills a niche for those with limited space or who need a compact antenna for portable excursions to a rare grid square or hilltop.

The RB-206B on the air

Over the few months that I used the

[1]For a description of the HB9CV mini-beam, see the RSGB *VHF UHF Manual* (4th edition), G. R. Jessop, G6JP, ed, pp 8.30 and 8.31.

RB-206B on the air, I found it to be a good performer. It had a good SWR match at the desired frequency and demonstrated good front-to-back and front-to-side rejection.

In my use of the antenna during both flat band conditions and sporadic enhanced propagation conditions, the antenna performed well when compared to the signals of stations I was working with my 12 W, and it worked well compared to what local stations nearby were able to contact. The W1VHF 6 meter beacon on 50.060 MHz—located nearby in FN41—was the first signal I heard with the antenna (why is it that the band always seems dead whenever you connect up a new antenna?). But as time went on, between casual operating and the 50 MHz ARRL Sprint, I logged several dozen QSOs and accumulated 20 new grid squares for my 6 meter VUCC.

The manufacturer does not specify a maximum power limit for this antenna. Raibeam told us, however, that their beams are tested at 1 kW continuous carrier and 1.5 kW PEP. I used both lower power (12 W) and higher power (100 W) with reasonable success in flat and enhanced conditions, including scatter, E skip and auroral propagation. I found that a small variation in antenna azimuth heading could significantly reduce some local power line noise in my neighborhood—without severely affecting the desired signal.

Summary

The Raibeam RB-206B antenna is a compact, lightweight, durable and portable antenna that packs lots of performance for its size. For the new or casual 6 meter operator, the RD-206B fills a need for an economical, yet good-quality antenna. Indeed, small antennas are not for everyone, but in today's amateur community we don't all have the luxury of tall towers and/or the absence of immediate neighbors. By the way, Raibeam makes similar antennas for HF and also has a line of multielement, long-boom antennas for the lower bands.

Postscript

After installing the antenna on my roof and using it for three months, I took it down for inspection. Structurally, the antenna appeared perfect, but I did notice some oxidation had developed on the phasing-line connection points. Raibeam says it now supplies improved connectors that hold up better than the tinned ones our unit had. For long-term installation, it's wise to protect these connections to prevent this kind of thing from happening.

Manufacturer: Raibeam Antennas International (a division of RAI Enterprises), 5638 W Alice Ave, Glendale AZ 85302; tel 602-931-9135; e-mail **wa7rai@raibeam.com**; **http://www.raibeam.com/**. Manufacturer's suggested retail price, $120, plus $30 shipping/handling.

Timewave DSP-59Y Audio Noise Reduction Filter

Reviewed by Paul Danzer, N1II
Assistant Technical Editor

Neat idea! That was my first impression when I pulled Timewave's latest package out of the box. Many years ago, I became the proud owner of a Yaesu SP-901P speaker. In addition to a speaker, the '901P included a phone patch. Since the cost of domestic long-distance calls has plummeted, requests to run phone patches no longer are very common. The people at Timewave spied the opportunity to give hams who own the newer Yaesu SP-5 and SP-6 speakers a chance to make better use of the empty accessory slot by manufacturing a DSP module that fits into in the space previously designed to accommodate a phone patch. In fact, the DSP-59Y is the only commercially available DSP filter designed to be integrated into an off-the-shelf speaker.

But here's the best part: the DSP-59Y module is essentially the same DSP box as the standalone DSP-599zx, minus some features. When we reviewed the DSP-599zx (see "Product Review," *QST* Dec 1996), we called it "a superb station accessory that earns high marks for its filter characteristics, noise reduction, and ease of operation." As with the DSP-599zx, the controls on the DSP-59Y are intuitive, the module installs easily into your speaker, and it can be used with minimum of time

BOTTOM LINE

Don't turn the page just because you don't own a Yaesu rig! The DSP-59Y can be used on the low-impedance audio outputs—and some high-impedance outputs—of most rigs, not just Yaesu rigs. You supply the appropriate Yaesu speaker cabinet. This DSP filter provides the same excellent performance as the self-contained DSP-599zx, with space-saving convenience.

Table 6
Timewave DSP-59Y Audio Noise Reduction Filter, serial number 21098

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Power requirements: 12-16 V at 1 A (max).	As specified. Tested at 13.8 V.
Frequency response:	Range at –6 dB points, (bandwidth):
CW, 10-600 Hz; attenuation, 55 dB at 60 Hz outside passband	600 Hz: 381-1020 Hz (639 Hz).* 500 Hz: 433-970 Hz (537 Hz). 100 Hz: 632-770 Hz (138 Hz).
Voice: Highpass, 100-1000 Hz; lowpass, 1000-5000 Hz; attenuation, 60 dB at 180 Hz outside passband.	300/1800 Hz: 257-1840 Hz (1583 Hz). 300/2100 Hz: 257-2140 Hz (1883 Hz). 100/5000 Hz (max): 33-5040 Hz (5007 Hz).
RTTY: 60-600 Hz; mark/space bandwidth, 60-100 Hz; center frequency, 2210 Hz, plus option of 1300, 1360, 1530, 1700 or 2125 Hz; attenuation, 40 dB at 60 Hz outside passband.	First passband (2140 Hz center frequency), 2080-2185 Hz (105 Hz); second passband (2300 Hz center frequency), 2240-2400 (160 Hz).
AMTOR, SITOR: Same as RTTY.	First passband, 2035-2193 (158 Hz); second passband, 2240-2400 Hz (160 Hz).
PACTOR: Same as RTTY.	First passband, 2000-22200 (200 Hz); second passband, 2235-2433 Hz (198 Hz).
SSTV: 1100-1300 Hz and 1500-2300 Hz.	1073-1325 Hz (252 Hz); 1480-2334 Hz: (854 Hz).
Random noise reduction: Up to 20 dB; varies with noise characteristics.	As specified.
Notch rejection: up to 50 dB; varies with noise characteristics.	Manual notch, ≥50 dB; automatic notch, ≥50 dB.
Time to notch: <5 ms.	≈7 ms to 50% points on oscilloscope.
Filter shape factor: Not specified.	1.1:1 typical, voice and CW.
Input/output delay: Not specified.	CW, 40 ms; voice, 24 ms; RTTY, 35 ms; SSTV, 26 ms.
Audio output power: 3 W into 8 Ω.	3.4 W at 10% THD into 8 Ω.

*All CW tests made at 700-Hz center frequency.

spent on the instruction book.

If anything, I liked the control layout and labeling on this unit slightly better than that on the standalone box. The display is clear and very visible over a wide range of angles. Packaging the filter in a speaker cabinet saves space, a valuable consideration if your operating table includes a rig or two, a PC keyboard and a PC monitor. It also eliminates cable clutter, so it contributes to a neat installation. Yaesu transceiver owners can keep that "original equipment" look through their station, too.

The unit I tested already had been installed in a Yaesu SP-5 speaker cabinet, but the installation instructions in the book were clear. A few screws and you are done. The instructions include a warning that some (non-Yaesu) rigs provide 12 V power that is not clean, and ground loop problems can result. The manufacturer recommends a separate power supply (12 to 16 V at 1 A). A jack at the back also accepts a connection to your rig's PTT line—needed, according to Timewave, if your rig does not fully mute the audio output during transmit.

Both an 8-pin DIN plug and a 9-pin RS-232 connector offer alternative input/output connections. If you plan just to use the filter on SSB and CW, you really just need to make two connections—12-V power and a phono connector for audio from your rig to the filter.

From an operating standpoint, the performance appeared to be identical to that of the DSP-599zx. The brick-wall filtering, noise-reduction and notching capabilities work very well (see Table 6); as we found with the DSP-599zx, the speaker-mounted unit was relatively insensitive to variations in input. An internal AGC is included, and I suggest using it! I found it very effective. The only *major* difference is that the DSP-59Y does not include the test instrument functions that the DSP-599ZX provides.

For all voice modes, the upper and lower edges of the bandpass are independently tunable. Press the **TUNE** control so the arrow symbol on the display points to the left, and you can adjust the bottom edge of the filter from 110 to 1000 Hz. Press again, so the arrow symbol points to the right, and you can adjust the upper filter edge from 1000 to 5000 Hz. Noise bothering you? One press of the **NR** button often works magic. Always and for all noise sources? No, but I found it to be very effective on many noise sources.

Heterodynes got you down? You have a choice of manual or automatic elimination. Take my word for it, in the automatic mode on 40 meter SSB, a broadcast heterodyne is often gone before you realize you have a problem.

As usual, with a DSP filter operating at the audio end of the receiver, don't look for a cure for interference caused by such things as intermodulation and front-end overload. But if the signal you want plus the interference are both within the dynamic range of the receiver, you can be in for a delightful surprise.

Manufacturer: Timewave Technology Inc, 2401 Pilot Knob Rd, St Paul, MN 55120; tel 612-452-5939; fax 612-452-4571. Manufacturer's suggested retail price: $389 (requires Yaesu SP-5 or SP-6 speaker, not included. Manufacturer's suggested retail price of the SP-5 or SP-6 is $157.). QST