Product Reviews

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Product Reviews:

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Alinco DR-B185HT VHF FM Mobile Transceiver

A basic workhorse for 2 meter FM.

Reviewed by Rick Palm, K1CE
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The Alinco DR-B185HT VHF FM mobile transceiver is a basic workhorse 2 meter FM radio that features a whopping 85 W RF output (switchable to a lower power output of 5 W). It's compact and has a surprisingly small heatsink, given the high power output. It's a one-piece radio — the front panel is not detachable — and offers extended receive coverage from 136 to 174 MHz.

Controls and Functions

The 2 × ¾ inch LCD display is easy to read. Backlight brightness is adjustable. Below the display are five pushbuttons — FUNC (function), V/M (VFO/memory mode), TS/DCS (tone squelch), CALL (call channel), and SQL (squelch adjustment). As with most radios, the buttons have primary functions and secondary functions. To access the secondary functions, press the FUNC button until an F appears in the display, then hit the desired button. The secondary functions — SET (exit the function mode), MW (write a frequency into memory), LOCK (lock the controls), H/L (high/low power level), and REV (reverse transmit and receive frequencies) — are labeled above the pushbuttons. Other functions, not often used, are available by pressing the FUNC button and one of the other buttons simultaneously.

The pushbuttons are backlit, so the primary function labels are easy to read. The secondary function labels are small and not illuminated, making them difficult to read under certain conditions. They would have been rendered more readable if they were placed along the bottom of the main LCD, where they would be backlit and larger.

The radio also has two rotary controls. VOL/PWR is a power switch and volume control. The other, a DIAL knob, is used to change VFO frequency or memory channel and adjust menu settings.

There are 38 settings that can be adjusted in the parameter setting mode, entered by pushing and holding the FUNC key. Parameters include channel step, alphanumeric memory names, auto power off, tone, scanning functions, and a number of other set-and-forget features.

One parameter was a source of initial irritation for me. There is a time-out-timer (TOT) that stops the transmitter and reverts to the receiver after a preselected amount of time — 30 to 450 seconds — to prevent the operator from talking too long. I was unaware of it at first, and it shut my transmission down at 30 seconds. With my antenna nearby, I thought I was getting the high-power RF back into the radio, playing the havoc. A radio TOT is a good idea for the long-winded operator, but the problem is that the operator seldom sees himself as such! Fortunately, this feature can be turned off.

Bottom Line

The Alinco DR-B185HT is a basic, solid performer that has a moderate learning curve. It would make a good addition to a home or mobile station, easily moved between the two with the use of common Anderson Powerpole connectors. It could use a third, mid-level output power choice in addition to the 5 W and 85 W settings.

ARRL Lab Testing

Test Engineer Bob Allison, WB1GCM, commented that he could not find the IF frequency, indicating that this is a direct conversion (DC) receiver. This topology is typical in mobile phones and commercial wireless equipment, and is becoming more common in amateur VHF/UHF gear. Two-tone, third-order IMD figures are excellent and adjacent channel rejection is good. Bob noticed that there is a clipping point with the receiver. Unwanted spurious responses start popping up at regular intervals across the dial with an input signal level greater than –15 dBm. The spurious responses are much stronger with an input level of 0 dBm. This could be a big issue when using the radio in a strong VHF RF environment, such as a transmitter site with multiple users.

Bob also noted that the RF output is exceptionally clean. The RF power output does sag as the dc voltage drops. It's 73 W at 12.5 V dc and 64 W at the specified minimum of 11.7 V dc. One should consider the power rating of the antenna to be used. Some mobile antennas are rated for only 75 W.

Using the Radio

Operation is typical for mobile radios. In the VFO mode, frequencies are selected by

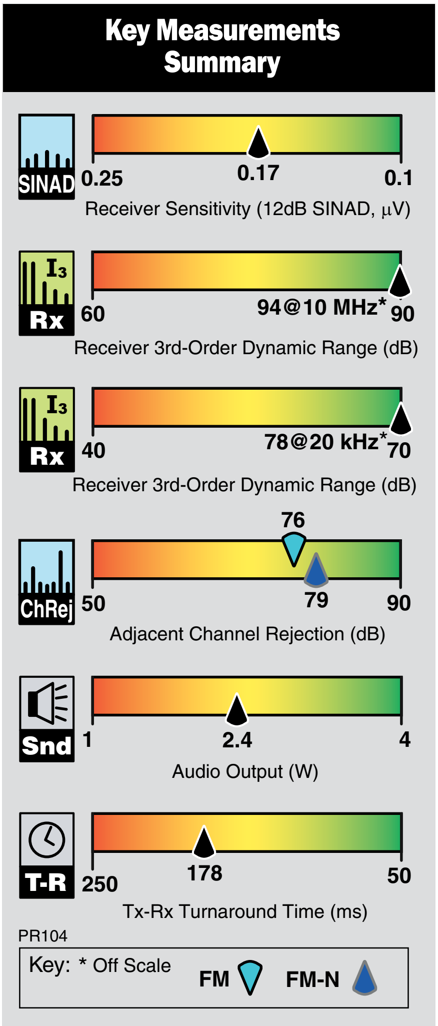

Table 1
Alinco DR-B185HT, serial number PH000652

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 136 – 173.995 MHz; transmit, 144 – 147.995 MHz.	Receive and transmit: as specified.
Modes: FM, FM-N	As specified.
Power requirements: Receive, <1 A; transmit, <20 A (high), <6 A (low) at 13.8 V dc ±15%	At 13.8 V dc: Receive, 510 mA (max audio max lights, no signal), 216 mA (standby, min lights). Transmit: 13.0/4.9 A (high/low RF output).
Receiver	**Receiver Dynamic Testing**
Sensitivity: FM, FM-N (12 dB SINAD), ≤0.25 µV.	FM and FM-N (12 dB SINAD): 0.17 µV.
FM two-tone, third-order IMD dynamic range: FM, ≥65 dB, FM-N ≥60 dB	20 kHz offset: FM and FM-N, 78 dB; 10 MHz offset: 94 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	85 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset: FM, 76 dB, FM-N, 79 dB.
Squelch sensitivity: 0.13 µV (threshold).	At threshold: 0.13 µV, 0.87 µV (max).
S-meter sensitivity: Not specified.	Full scale indication: 4.07 µV.
Audio output: ≥2 W at 10% THD.	2.4 W at 10% THD into 8 Ω. THD at 1 V_{RMS}, 1.55%.
Transmitter	**Transmitter Dynamic Testing**
Power output: 85/5 W (hi/low).	82/5.9 W high/low at 13.8 V dc.
RF output at minimum operating voltage: Not specified.	64 W at 11.7 V dc.
Spurious signal and harmonic suppression: ≥60 dB.	>80 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S-9 signal: 178 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	66 ms.
Size (height, width, depth): 1.6 × 6.3 × 7.2 inches (incl protrusions); weight: 3.3 lbs.	
Price: $170.	

rotating the DIAL knob. (Push the DIAL knob to change frequency in 1 MHz steps for speed in frequency selection.) You must manually select the offset frequency direction by pushing the FUNC key, followed by pressing the DIAL knob to cycle through the choices — positive, negative, or no offset. Many transceivers preprogram the offset direction per convention and band plan (for example, such a radio would automatically select the offset as positive for a repeater on 147.15 MHz), and it would have been nice if Alinco included that feature on this radio. The offset frequency (split) itself is preprogrammed at the typical 600 kHz, but can be changed in the parameter settings mode. Some repeaters use a 1 MHz split, for example.

There are 500 memory channels, one call channel, a priority channel, and a pair of program-scan edge memory channels for scanning utility. Memories are programmed — for a repeater, for example — by entering the VFO mode and selecting the frequency, tone squelch frequency if one is required, low or high power, and offset direction. When all the settings are complete, pushing the FUNC key will show the F and M (memory) icons on the display screen, along with a channel indicator such as a number for a channel, or a letter such as C for call channel, or PR for priority channel, or P1, P2 for scan edge memory channels. Rotate the DIAL knob to cycle through the memory channels: A flashing M icon indicates a blank memory channel has been selected and is ready for storage of a frequency and settings, copied from the VFO mode selection. You can also overwrite memory channels.

According to the manual, to delete the contents of a memory channel, you would first select it in memory mode. Then, while the radio is in FUNC mode with the F icon illuminated on the screen, you would push the FUNC and V/M buttons together. The M icon flashes once again to indicate that the channel is empty. My experience, however, was that the memory channel contents were deleted simply by selecting the channel in memory mode, and then pushing the FUNC and V/M keys at the same time — it was not necessary to have the F icon activated/displayed. On a related note, it requires some dexterity and practice to hit the two keys at just the right time to perform the function of deleting the channel's contents.

It is best to program your memory channels in groups of channel numbers for organizational and scanning purposes. For example, I live in two places — one on the weekends when I work in Daytona Beach, Florida, and the other mid-week, 150 miles away near the Suwannee River. Each area has its own community of repeaters, of course. I programmed Daytona-area repeaters in channels 1 – 5, and Suwannee-area repeaters in channels 10 – 15. When scanning memory channels in Daytona Beach, I first select a channel in the 1 – 5 range, then push the DIAL knob to start scanning, which will automatically be limited to channels 1 – 5. When I am out at my Suwannee-area home, I first select a channel in the 10 – 15 range, then push the DIAL knob to scan the memory channels limited to that range. With almost 500 channels, the operator could set up many groups for efficient scanning purposes. I liked this method.

The programmed frequency scanning function and custom selection of limits is perhaps atypical, at least in my experience, but works well. Again, let's use an example: I programmed edge P1 at 146.500 MHz, and edge P2 at 147.000 MHz. In VFO mode, if I select a frequency between these two frequencies and start the scan, the radio will scan only between these two frequencies. If I select a frequency below P1, for example, 146.250 MHz, the radio will scan between the VFO's lower limit and the P1 frequency of 146.500 MHz. When a frequency higher than P2 is selected and the scanning function is started, the radio scans only the frequencies between P2 and the upper limit. The VFO's lower limit is selectable in the parameter settings mode, with a lower absolute limit of 136 MHz; the upper absolute limit is 174 MHz.

On the Air

On the assets side of the balance sheet, I liked two features immediately. First, the speaker is mounted on the front of the radio so that the audio is directed straight out at the user! It lends the radio a bit of a retro look, but it's the best way for mobile operators to easily hear received transmissions in potentially high ambient noise environments, such as the cab of my pickup truck. (Typically, radios have speakers mounted on the top or bottom panels, directing the audio up or down, yielding compromises in audio reception.) The second feature that I liked right off the bat is the mounting bracket with thumbwheel mounting screws. The bracket is slotted so that the radio can be removed and replaced quickly by simply loosening the thumbwheel screws and sliding the radio into and out of the slots. The thumbwheel screws are more efficient than the conventional screws typically found in other radio mounting schemes, as no screwdriver is required.

I solicited audio reports from my QSO partners — all were favorable. Audio booms out of the front-mounted speaker, discussed above. The mic has a keypad, handles simple commands/functions, and uses an older style round eight-pin mic connector (most mobile VHF radios these days employ the modular connector). It is unfortunate that there is not more standardization of connectors, including dc power cable connectors, across the spectrum of Amateur Radio products. Such standardization would go a long way toward interoperability, the mantra in public safety communications in the post-9/11 era. The ARES/RACES standard Anderson Powerpole connector is certainly a step in the right direction.

Mid-Level Power Output Needed

While I agree that the high power output of 85 W is useful when suboptimal conditions pose challenges to reaching a distant repeater or simplex operator, the only other option (front panel switchable) is the low power setting offering a mere 5 W. While using the low power setting has the advantage of reducing the demand on a battery, it simply may not be enough power for many common operating environments. The use of 85 W imposes significantly more drain on emergency power sources in the field, obviously.

The point is, the addition of an intermediate power output choice would add more utility and efficiency to this radio. As an active ham who makes adapting a radio station for emergency management purposes a hobby within a hobby, I look at these specs carefully.

Parting Thoughts

The DR-B185HT looks and feels solidly built, as though it could withstand some abuse in the field. It's easy to operate, and the learning curve isn't too steep, although you will need the manual for some of the more esoteric functions.

Manufacturer: Alinco, Inc, Yodoyabashi Dai-Bldg 13F, 4-4-9 Koraibashi, Chuo-ku, Osaka 541-0043 Japan; **www.alinco.com**. Distributed in the US by Remtronix (**www.remtronix.com**) and available from Amateur Radio dealers.

See the Digital Edition of *QST* for a video overview of the Alinco DR-B185HT VHF FM mobile transceiver.

M² LEO-Pack Satellite Antenna System

Reviewed by Peter Budnik, KB1HY
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With a resurgence of interest in low Earth orbiting (LEO) Amateur Radio satellites, and plans in the near future for more launches and satellites on the air, M² has released an antenna system optimized for contacting these LEO "birds."

The LEO-Pack Antenna System includes two circularly polarized antennas: the M² 2MCP8A for 2 meters and the M² 436CP16 for 70 centimeters. Both antennas are optimized for LEO satellite frequencies. To complete this dual-band system, a boom-to-mast plate and 8.5-foot crossboom are included to mount the two antennas on the same plane.

The 2MCP8A covers 143 to 148 MHz and has a total of eight elements, with four in the horizontal and four in the vertical positions. The vertical and horizontal elements are offset from each other and are not spaced evenly across the boom, as are some other circularly polarized antennas. The boom for this end-mounted antenna has a total length and turning radius of 64 inches.

The 436CP16 covers 432 to 440 MHz and has a total of 16 elements with eight in the horizontal and eight in the vertical positions. As with the 2 meter antenna, the vertical and horizontal elements are offset on the boom. The boom length and turning radius is just slightly longer than its 2 meter counterpart at 65¾ inches.

All antenna elements are made of aluminum, and fastening hardware is stainless steel. Elements are mounted through the boom with shoulder washers and keepers. Both antennas include two CNC machined, O-ring and silicone sealed block assemblies for the driven element and T-match on the vertical and horizontal Yagis. Construction is similar to that found on other M² VHF/UHF antennas. Feed line connectors are both rear-mounted Type N females, which allows for easy routing of cable as well as placement of optional preamps. With similar boom lengths and a matching weight of 4 pounds, these antennas are well suited for end mounting on a shared crossboom.

The FGCBLEOPACK aluminum crossboom has an overall length of 9 feet and a diameter of 1.5 inches. It includes stainless-steel fasteners and nylon insert lock nuts. The supplied boom to mast clamp will accept a mast with a diameter up to two inches.

Figure 1 — The 2 meter and 70 centimeter antennas installed on the crossboom and mounted on a short tower. (Note that the author accidentally bent one of the 2 meter reflectors slightly while installing the antennas. The elements were all perfectly straight when delivered.)

Unpacking

The LEO-Pack arrives in a 47 × 5.5 × 5.5-inch carton, with the crossboom broken down into three pieces and antenna booms broken down into two pieces. Although parts are well protected in the box and all hardware is bagged in plastic and antenna elements are bundled together, two of the four tags marking the driven elements had fallen off. RG-6/U cables are precut and assembled using weatherized connectors for the balun and phasing lines for both antennas. An inventory of parts revealed spare hardware including element keepers, which come in handy if you make a mistake in centering an element or need to disassemble the antenna in the future.

The rough finish of the crossboom was a bit of a surprise, with stamping still visible on the sides of the three sections and an overall unfinished look and feel. This has no effect on the performance, but did not match the finish quality of the antennas.

Bottom Line

The M² LEO-Pack offers a complete antenna system for low Earth orbit (LEO) satellite operation. Assembly is straightforward and requires a few basic hand tools.

Assembly

Three separate assembly manuals are included for the two antennas and the cross boom. The crossboom manual consists of an inventory sheet and assembly diagram, while the antenna manuals contain complete assembly instructions. The two antenna manuals make no reference to the combined use of the antennas on the crossboom. In fact, the "Installation Tips" section in both antenna manuals recommends that the antennas are not mounted to a metal (conductive) mast or crossboom! Because a metal crossboom is provided in the LEO-Pack, a quick call to M^2 verified that performance would not be affected. M^2 assured me that a conductive mast or crossboom is only a problem when mounting on the center of the antenna boom. This was not clear in either of the antenna assembly manuals.

Tools required for the assembly are a screwdriver, 11⁄32-inch nut driver, 7⁄16 and ½-inch open or socket wrenches, and a tape measure. I highly recommend that you separate the parts for each of the antennas and the crossboom to ensure no parts are mistakenly used on the wrong antenna. The assembly procedure is the same for both antennas.

Element installation consists of measuring and separating all elements. As recommended in the manual, it is best to install the elements one plane at a time. Because some elements are close to each other in length, measurements should be taken carefully to avoid installing the elements in the wrong order. SAE measurements for element length and spacing are given in the manual, but they are listed in decimals and require conversion for most common measuring tapes. The driven element block is installed after all of the elements of one plane are complete. Careful attention must be paid to the orientation of each of the driven element blocks, as this will determine the circularity of the antenna.

After all the elements and blocks are complete, the pre-assembled RG-6/U balun and phasing lines are installed. The weatherized F connectors should be tightened carefully using a 7⁄16-inch wrench to help keep moisture out of the connections. The final step of the antenna assembly is adding the boom-to-mast clamp at the end of the boom.

With both antennas now complete, the crossboom is assembled using the provided hardware. When asked if only two sections of the crossboom could be used to shorten the installation width of the overall array, M^2 recommended that the entire boom length be used to ensure proper spacing of the antennas to avoid any interaction. Antennas are easily end-mounted to the crossboom in the same plane or, if no elevation rotator is available, the antennas can be attached at a fixed angle relative to the crossboom-to-mast mount.

Assembly of the LEO-Pack is straightforward and relatively easy if you have previously assembled Yagi antennas and if you follow the directions carefully. I took my time and had to correct a mistake, which brought the total assembly time to 6 hours.

Installation

As shown in Figure 1, I installed the LEO-Pack on a 15-foot tower attached to the deck in the backyard using an Alliance HD 73 rotator for azimuth and a Yaesu G-500A rotator for elevation. Forty feet of LMR-400 coax was used to connect the antennas to a Yaesu FT-847 transceiver. An SWR check on both antennas showed 1.2:1 across the frequency range for both antennas, and I saw no drop in power from one end of the range to the other.

Performance

My first contact attempt was with the SO-50 satellite. The first pass had a maximum elevation of 20°, pretty close to the horizon. With tree cover in the summer affecting 70 centimeters, I was unable to hear any activity on the satellite. The next pass had a high maximum elevation, and at about 30° many signals could be heard. On the next SO-50 pass that was above 30°, I transmitted my call sign and could hear myself on a second receiver. I called again and was answered by a station in Michigan. When the elevation was right for my local terrain, I was able to make contacts easily on both the AO-73 and FO-29 satellites. On the analog FO-29 passes, I made DX contacts with European stations while the satellite was over the Atlantic.

I also tried a couple of experiments to see if antenna performance would be affected. The first was to put Advanced Receiver Research preamps for 2 meters and 70 centimeters inline for a few low-elevation passes, to see if there was an improvement in reception. Depending on the direction from which the satellite arrived, I was able to hear the signals about 10° lower than when the preamps were not used. Because I was still concerned about the antenna instructions regarding the use of conductive mast or crossboom material, I swapped out a metal mast for a fiberglass one. Checking the SWR and comparing it to earlier measurements showed no change between the two tests, which confirmed what M^2 had told me on the phone.

Conclusion

Overall, I was quite happy with the results from the M^2 LEO-Pack satellite antenna system. This comprehensive system allows satellite operators who are looking for the next step up from their portable, handheld antennas to install a permanent and durable satellite array on a small lot. While there are larger, circularly polarized antennas available that will provide more gain, the size and completeness of the M^2 system are very appealing. Problems with assembly were minimal. Although I would like a single manual for the entire system and the minor discrepancies corrected, the directions were clear and easy to follow. For satellite operators looking for a complete antenna system for their LEO satellite operations, I would certainly recommend the M^2 LEO-Pack. Thanks to Matt Wilhelm, W1MSW, for his help with this review.

Manufacturer: M^2 Antenna Systems, 4402 N Selland Ave, Fresno, CA 93722; tel 559-432-8873; **www.m2inc.com**. Price: $595. Available through AMSAT with special pricing for AMSAT members (see **www.amsat.org**).

MyAntennas End-Fed Half-Wave Antenna for 80 – 10 Meters

Reviewed by Joel R. Hallas, W1ZR
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A long-standing desire of many hams is to be able to operate all the HF amateur bands using a single antenna. The MyAntennas EFHW-8010-1K promises to allow just that.

The antenna consists of approximately 130 feet of #18 AWG black insulated wire and a sealed matching unit (about 6 × 5 × 2 inches) with stainless hardware and a silver-plated, Teflon-insulated UHF socket. Included in the box was a folded instruction sheet that had sufficient information for someone to install and use the antenna.

The instructions indicate that it will provide a good match on the 80, 40, 30, 20, 17, 15, 12, and 10 meter bands whether at a height of 10 feet or 50 feet. Note that 60 meters is not included on the list. In addition to the connections to the antenna wire and coax, the instructions suggest that a ground wire as short as possible be connected to the GROUND terminal on the matching unit.

Hanging It Up

I hung the matching unit about 6 feet above ground (see Figure 2) and about 8 feet from my cable entrance facility. The unit was grounded to the entrance facility, which has multiple rods and radials and an underground connection to my service entrance ground about 20 feet away. While intended more as a lightning protection ground than a counterpoise, it is probably typical of many amateur station grounds.

The antenna wire was sloped upward to a surplus halyard that brought it to about 25 feet about ¾ of the way along its length. The remainder of the wire came down to about 8 feet above ground with the end insulator secured to a handy tree. The coax to the entrance facility passed through a lightning arrestor and then via about 50 feet of low-loss RG-8 sized coax to my station. While this is certainly not an ideal installation, it may be typical of what others will do, and it is within the guidelines of the manufacturer's instructions.

First Impressions

First I looked at the impedance characteristics to see if the antenna really could be fed directly on all the bands indicated above. It was surprisingly close. The instructions

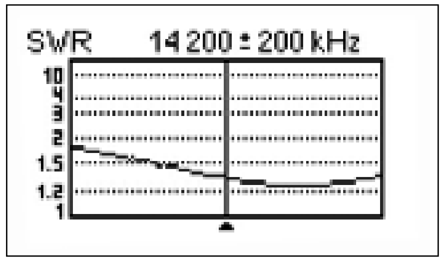

Figure 3 — Measured SWR of the EFHW-8010-1K in the reviewer's station across 20 meters. This is fairly typical of what we observed.

Figure 2 — The EFHW-8010-1K matching unit hanging from the wall above my feed line entrance facility. Because I was unsure of the connectivity within the unit, I tied the ground terminal to the outside of the coax outer conductor using a PL-258 adapter with the wire fastened between two nuts.

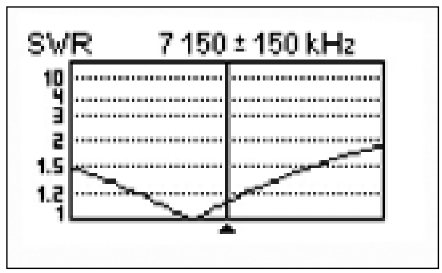

Figure 4 — Measured SWR of the EFHW-8010 in the reviewer's station across 40 meters. Note that the full band is covered at less than a 2:1 SWR.

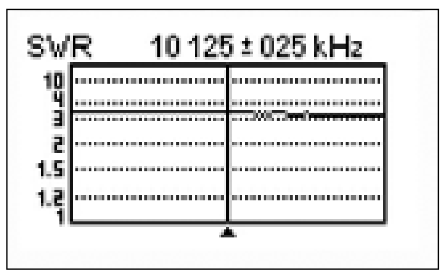

Figure 5 — Measured SWR of the EFHW-8010 in the reviewer's station across 30 meters. This was the band with the worst SWR, and still likely within the range of "trimming" type antenna tuners.

Bottom Line

The EFHW-8010-1K provides an easy-to-deploy antenna that can be operated on all HF bands, except 60 meters, with a low enough SWR to be used without an antenna tuner on most bands. Being able to feed the antenna from an end may make it a good solution for many support configurations.

Table 2
EFHW-8010-1K SWR Measurements

Frequency (MHz)	Manufacturer's "Typical SWR"	SWR Measured At Entrance Panel	SWR Measured At Station
3.60	1.5:1	2.0:1	2.0:1
7.05	1.2:1	1.3:1	1.3:1
10.1	1.5:1	4.0:1	3.3:1
14.2	1.1:1	1.4:1	1.4:1
18.1	1.5:1	2.0:1	1.8:1
21.2	1.3:1	1.2:1	1.1:1
24.9	1.2:1	1.1:1	1.1:1
28.5	1.4:1	2.3:1	2.0:1

provide "typical VSWR reading across the bands," which are shown in Table 2 along with my measurements on the same frequencies. Table 2 shows measurements at my ground-level entrance panel, along with another set made in my upstairs station at the end of 50 feet of coaxial cable. The instructions note that the SWR will vary with height and surrounding objects.

These results seem fairly remarkable to me. The antenna can be driven by most transceivers without an antenna tuner on most bands and with a typical built-in "trimming tuner" on others. While the specifications indicate that operation at power levels up to 1 kW is possible, I was able to put out only 500 W and had no indications of problems at that level.

Some may be suspicious of low SWR as indicative of losses, or that these frequencies are "cherry picked" at a magic frequency. The results of swept analysis on representative bands, shown in Figures 3 through 6, are notable in two respects. First, the response is nicely wide across most bands. Second, the SWR goes high outside the bands, indicative of low losses. Higher-loss antenna systems tend to have flatter SWR curves.

The response on 80 meters (see Figure 6) was at least as wide as that from a center-fed wire dipole, and could be shifted up in frequency by shortening the wire. I didn't try that, because I was concerned about the impact on the response of the higher frequency bands due to the change. Again, as provided, it was perfect for the CW op, and within range of the typical tuner on

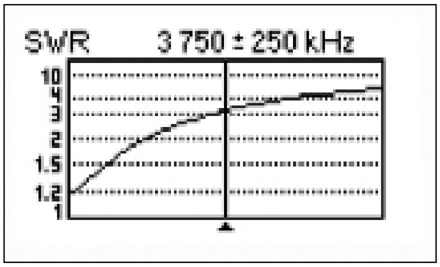

Figure 6 — Measured SWR of the EFHW-8010 in the reviewer's station across 80 meters. Note the very low SWR at the bottom of the band. The manufacturer suggests trimming for best SWR. Based on a dipole model, removing about 8 feet of wire should bring it right in.

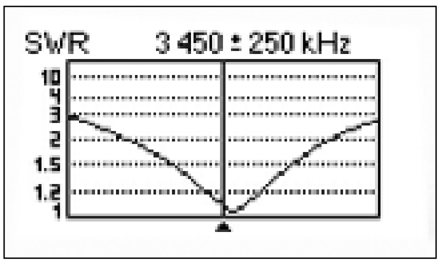

Figure 7 — Measured SWR of the EFHW-8010 in the reviewer's station with the antenna analyzer centered below the bottom of 80 meters. This is indicative of how the antenna would operate over 80 meters if it were shortened to move its resonance to mid band.

the high end. Figure 7 shows the 80 meter SWR curve with the antenna analyzer centered on the low SWR point. This is indicative of what you might be able to achieve with some tweaking of the antenna length.

I was also surprised at how well this antenna worked during on-air testing, especially considering my less-than-optimum installation. I compared it in an A/B fashion with my 80 meter center-fed half wave, up considerably higher, and in a similar, but not identical, orientation. On most bands the EFHW played better with mid-range signals than longer distance ones, often down about an S unit or two at the longer ranges. Even so, I was able to make contacts and, in some cases, the EFHW outperformed my higher dipole, likely because of the different pattern on the higher bands with nulls at different azimuths. Still, it was possible to work and get reasonable signal reports from most stations I could hear.

That Sealed Box

An e-mail exchange with the antenna's designer, Danny Horvat, E73M, yielded the following response: "…it is simple 1:7 ratio (1:49 [impedance] transformation) on ferrite material producing minimum possible loss from 3 – 30 MHz." Danny goes on to say that he has spent considerable effort experimenting with different ferrite mixes and configurations to obtain the minimum loss.

Because I had no way to independently determine the loss at W1ZR, other than through dc measurements between coupling unit terminals — all of which indicated copper connections — I took the coupling unit to the ARRL Lab. Working with Senior ARRL Lab Test Engineer Bob Allison, WB1GCM, we adapted the Lab's usual antenna tuner test routine to test the coupling unit. We used the highest impedance test load — 800 Ω — and measured the power delivered to the load compared to the net power delivered to the coupling unit on multiple bands. The output power was equal to the input power, within the readability of the less than ideal test setup, indicating minimal loss.

MyAntennas offers other antenna configurations including an end fed 40 –10 meter antenna (EFHW-4010) as well as a number of off-center fed dipoles.

Manufacturer: EuroXpress Corporation d/b/a MyAntennas.com, 40415 Chancey Rd, Suite 105, Zephyrhills, FL 33542; tel 813-298-5358; **myantennas.com**. Price: $150.

RigExpert AA-230 ZOOM
0.1 – 230 MHz Antenna and Cable Analyzer

Reviewed by Phil Salas, AD5X
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RigExpert offers a number of antenna analyzers, with the AA-230/230PRO being one of the more popular versions. The AA-230 ZOOM is the next generation, adding features such as a color display, more convenient powering, easier software updates, and graphical zoom capability.

Overview

The AA-230 ZOOM is a single-port vector network analyzer (VNA) that provides signed, complex impedance measurements of RF loads from 100 kHz to 230 MHz with a frequency resolution of 1 kHz. The measurement port is an N-female connector, but a UHF-to-N adapter is included. A USB A/B cable is provided for computer interfacing, along with a user manual for standalone operation and a separate software manual.

For standalone use, power is provided by four 1.2 – 1.5 V AAA NiMH or alkaline batteries, accessible through a rear battery compartment cover (NiMH batteries must be charged externally). A battery indicator on the main menu shows the battery status. When a computer is connected, power is provided through the USB connection. Frankly, I like the trend toward having an easily accessible battery compartment in that you don't need to remember to charge your analyzer prior to use. Just pop in some fresh alkaline batteries and go.

All information is displayed on a 2 × 1.5-inch TFT color screen. You can select a single frequency display, a swept-frequency display, a Smith Chart display, or a TDR (Time Domain Reflectometer) display. The single frequency modes lets you select displays of SWR, impedance (Z, R, and X), or the equivalent series and parallel representation of an impedance. The swept frequency mode displays SWR or return loss, or impedance (R/X). The TDR display can be used for finding coax cable discontinuities. The graphical displays can be expanded with the ZOOM feature for enhanced reading accuracy.

The AA-230 ZOOM can operate as a signal generator. Its output waveform is a

square wave rich in harmonics, however, so this must be considered when making measurements. The AA-230 ZOOM can zero out a transmission line for making accurate remote antenna feed point impedance measurements if calibration standards are available.[1]

Finally, the AA-230 ZOOM may be connected to your computer to provide additional data recording and analysis capabilities. Internal memory provides for the storage and recall of measured parameters in a variety of formats.

> **Bottom Line**
>
> The RigExpert AA-230 ZOOM is a flexible and accurate antenna analyzer that will satisfy most antenna and component measurement requirements.

Testing

Table 3 summarizes the general specifications versus measured performance of the AA-230 ZOOM. Table 4 displays its output impedance measured with no termination at the N connector. This gives an indication of the impedance magnitude you can measure accurately as a function of frequency.

When checked against the 10 MHz WWV signal, I did not detect any noticeable frequency drift over a 5-minute test period. Also, the frequency was almost zero-beat with WWV (the frequency readout is adjustable if desired).

The output level is quite constant over the full frequency range, making the AA-230 ZOOM accurate enough for receiver sensitivity testing when used with a good step attenuator. Just keep in mind that the output waveform is not a pure sine wave. Table 5 tabulates the output power level versus frequency measured with my MiniCircuits PWR-6GHS+ power sensor.

Next I measured SWR and impedance measurement accuracy using low-and-high-impedance 2:1 and 3:1 SWR loads, and homebuilt 7.5 Ω (theoretically 6.67:1 SWR) and 400 Ω (theoretically 8:1 SWR) loads.[2] The AA-230 ZOOM SWR measurements are tabulated in Table 6 as compared to an Array Solutions AIMuhf impedance analyzer.

Finally, Table 7 displays the AA-230 ZOOM measurements of three complex loads, each approximately 50 –j36 Ω at their measured frequencies, compared to the Array Solutions AIMuhf. (See Note 2.) As you can see, the AA-230 ZOOM provides excellent measuring capability. Note that the correct sign of the reactance is displayed.

Using the AA-230 ZOOM

Before using the AA-230 ZOOM for the first time, check that you have the latest firmware. This is a simple process. Go to **www.rigexpert.com**, select the "AA230 ZOOM" tab, and then run the Firmware Update Tool. This tool finds the AA-230 ZOOM connected to your

Table 3
AA-230 ZOOM, serial number n/a

Manufacturer's Specifications	Measured Performance
Frequency range: 0.1 – 230 MHz.	As specified.
Frequency resolution: 1 kHz.	As specified.
Output power: –10 dBm into 50 Ω.	See Table 5.
Output signal shape: Square wave.	Harmonics: 14 MHz: 2nd –10 dBc, 3rd –13 dBc. 222 MHz: 2nd –23 dBc, 3rd –10 dBc.
Measurement systems: 25, 50, 75 and 100 Ω.	As specified.
SWR range: 100:1 numerical, 10:1 graphical.	SWR of ∞ is indicated into open circuit.
R, X range (numerical): 0 – 10 kΩ, ±10 kΩ.	Less than ±10 kΩ above 28 MHz.
R, X range (graph): 0 – 1000 Ω, ±1000 Ω.	Less than ±1 kΩ at 144 and 222 MHz.
Power: USB interface or four AAA 1.5 V alkaline or 1.2 V NiMH batteries.	
Battery operating time: 4 hours continuous, 2 days standby.	
Dimensions (height, width, depth): 7.2 × 3.2 × 1.3 inches; weight, 8.3 oz.	
Price: $550.	

Table 4
Output Impedance

Frequency (MHz)	Output Impedance (Ω)
1.8	>10,000
3.5	>10,000
7	>10,000
14	>10,000
28	4500
50	2500
146	750
222	476

computer and determines the current version of your firmware. If a newer version of firmware is available, the update tool downloads and installs it into the analyzer.

The AA-230 ZOOM is very easy to use. The menus and keypad markings are quite self-explanatory, so you will rarely need to refer to the manual. Setting the frequency and frequency range for scans is very easy. The ZOOM capability permits you to scan a wide frequency range, use the < and > keys to center the frequency of interest, and then use the ∧ and ∨ buttons to zoom in or out in order to get more or less detail.

My main antenna, a Hy-Gain TH-1 rotatable dipole, consists of a 20/15/10 meter trap dipole with a 6 meter fan dipole element. As the 6 meter dipole is close to a ¾ wave dipole on 2 meters, I took advantage of the multiband feature of the AA-230 ZOOM to look at all five bands as shown in Figure 8.

Next I took a 10 – 60 MHz scan of the antenna as shown in Figure 9. You can clearly see the four ham bands covered by this scan. Use the < and > buttons to center the frequency of interest for more detail.

Next I used the ZOOM feature to expand the 20 meter section of the display. As you can see in Figure 10, you may lose some resolution when you zoom in on a small section of a large sweep. Figure 11 shows a direct scan (not using the ZOOM feature) of the same frequency range.

As discussed earlier, single-frequency parameters may also be displayed. A single band, or a section of it, can be displayed to provide detailed impedance information.

There are many other useful features available in the AA-230 ZOOM. These include the ability to measure cable length, cable loss, velocity factor, and characteristic impedance. The TDR function is useful for determining discontinuities in your antenna system. I used the TDR feature to determine the physical length of coax from my operating position to my 43-foot vertical, which I'd estimated to be about 60 feet. The AA-230 ZOOM gave me the exact answer — 53.63 feet — as shown in Figure 12.

Table 5
Output Power (dBm) vs Frequency

Power measured with a NIST-traceable MiniCircuits PWR-6GHS+ power sensor.

Spec Power (dBm)	Measured Power (dBm) at Frequency (MHz): 1.8	3.5	7	14	28	50	144	222
–10 typical	–7.9	–7.9	–7.9	–7.9	–8.0	–8.0	–8.1	–8.2

Table 6
Resistive Load Measurements

Loads measured with the AA-230 ZOOM compared to the AIMuhf.
LoZ = low impedance resistive load. HiZ = high impedance resistive load.

Frequency (MHz)	2:1 SWR LoZ AA230Z/AIM	2:1 SWR HiZ AA230Z/AIM	3:1 SWR LoZ AA230Z/AIM	3:1 SWR HiZ AA230Z/AIM	7.5 Ω Load AA230Z/AIM	400 Ω Load AA234Z/AIM
1.8	1.98/2.02	2,1/2.02	3.1/3.18	3.0/2.99	6.6/6.77	8.1/7.94
3.5	1.97/2.02	2.1/2.02	3.1/3.17	3.0/2.98	6.6/6.78	8.1/7.93
7	1.97/2.01	2.1/2.02	3.1/3.17	3.0/2.99	6.6/6.78	8.1/7.94
14	1.97/2.00	2.1/2.02	3.1/3.16	3.0/2.99	6.6/6.76	8.1/7.96
28	1.96/2.00	2.1/2.02	3.1/3.14	3.0/3.00	6.6/6.73	8.1/7.97
50	1.96/2.00	2.0/2.03	3.1/3.13	3.0/2.99	6.5/6.79	8.0/7.91
146	1.99/1.99	1.97/2.01	3.1/3.13	3.0/2.99	6.5/7.11	7.9/7.62
222	1.98/1.97	1.95/2.01	3.1/3.14	3.0/2.96	6.6/7.28	7.5/7.25

Table 7
Complex Load Measurements

Loads measured with the AA-230 ZOOM compared to the AIMuhf.

Frequency (MHz)	---- AA-230 ZOOM ----		--------- AIMuhf ---------	
	SWR	Impedance (Ω)	SWR	Impedance (Ω)
50	1.96	45 – *j* 32	1.94	47 – *j* 33
144	1.84	39 – *j* 25	1.80	45 – *j* 28
222	1.78	34 – *j* 18	1.76	42 – *j* 25

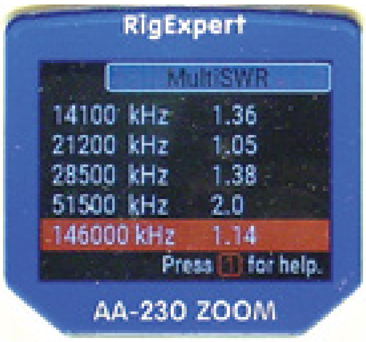

Figure 8 — Using the AA-230 ZOOM's multi-band feature to check the author's TH1 antenna on 20,15,10, 6, and 2 meters.

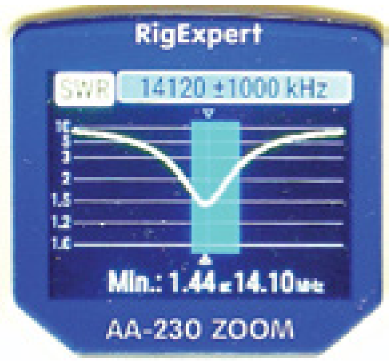

Figure 11 — A direct 20 meter scan (not using the ZOOM feature).

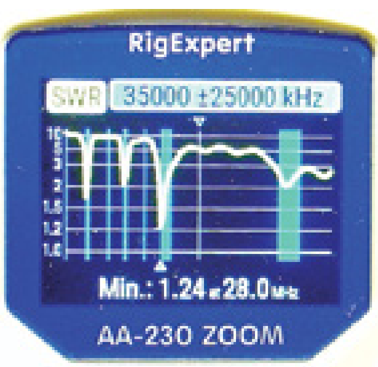

Figure 9 — A 10 – 60 MHz scan of the author's TH1 antenna. Note that the frequency of minimum SWR is indicated.

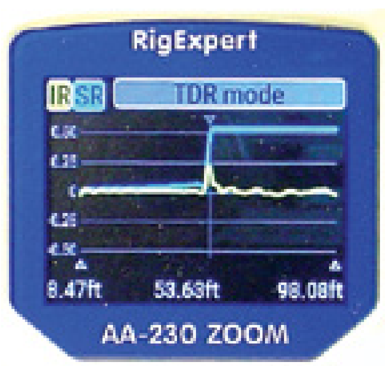

Figure 12 — The AA-230 ZOOM's TDR mode used to find the length of feed line to the author's 43-foot vertical.

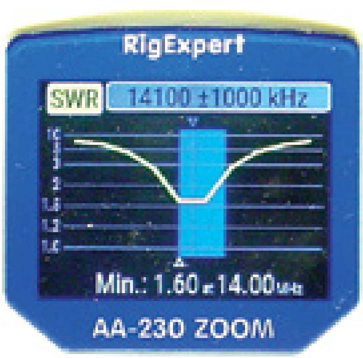

Figure 10 — A ZOOMed 20 meter scan.

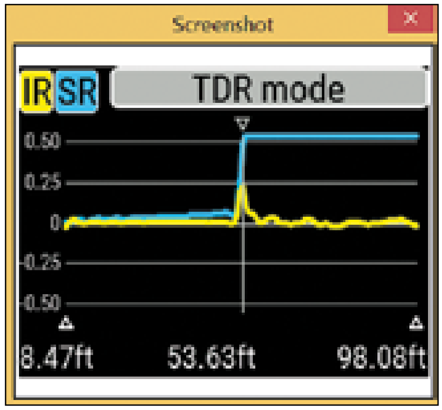

Figure 13 — Using the *AntScope* software to view the TDR measurement of Figure 12.

Computer Interface

RigExpert provides a powerful, easy-to-use program called *AntScope* that permits importing data from the AA-230 ZOOM memory, as well as providing for real-time control of the analyzer. Figure 13 is the *AntScope* capture of the Figure 12 TDR display.

Conclusion

The AA-230 ZOOM is an accurate antenna and component analyzer that can be an indispensable tool for most hams. You can investigate it further by reviewing the manual on the RigExpert website.

Manufacturer: Rig Expert Ukraine Ltd, Yakira St 17A, 04119 Kyiv, Ukraine; **www.rigexpert.com**. Available from many US dealers.

Notes

[1]P. Salas, AD5X, "MFJ-226 Graphical Antenna Impedance Analyzer," Product Review, *QST*, Dec 2015, pp 39 – 42. See the sidebar on page 41.

[2]P. Salas, AD5X, "SARK-110 Vector Impedance Antenna Analyzer," Product Review, *QST*, Nov 2015, pp 62 – 64.

See the Digital Edition of *QST* for a video overview of the RigExpert AA-230 ZOOM 0.1 – 230 MHz antenna and cable analyzer.