Product Review Column from *QST* Magazine

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Kenwood TR-7850 2-Meter FM Transceiver

KLM 144-148-13 LB Antenna

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Yaesu FT-480R 2-Meter Multimode Transceiver

Product Review

Conducted By Paul K. Pagel,* N1FB

Yaesu FT-480R 2-Meter Multimode Transceiver

This is one of a new breed of multimode 2-meter transceivers from Japan. It covers the entire 144-MHz amateur band (and then some) and operates on fm, upper and lower sideband, and cw. A versatile radio, the '480R is equally convenient to use in your automobile or at your home station.

Frequency Control

The FT-480R operating frequency is determined by a microprocessor-controlled PLL circuit composed of three PLL oscillators, each consisting of a reference crystal oscillator, a programmable divider, a prescaler and a phase comparator. The circuit develops local signal voltages for the receiver and transmitter stages using a synthesis scheme that produces 10-Hz steps. A 4-bit CPU controls the PLL circuitry. This CPU halts transmission and prevents spurious radiation if any VCO is unlocked. A seven-digit fluorescent-blue readout displays the operating frequency.

Aside from the main tuning knob, 13 of the controls are related to frequency selection. The STEP switch controls the 10-Hz, 100-Hz or 1-kHz increments on ssb and cw, and 1-kHz, 20-kHz or 100-kHz increments on fm. The CLAR switch provides a function similar to RIT. When the CLARifier switch is depressed, the operator can use the main tuning knob to move the receive frequency ± 10 kHz from that indicated by the readout without changing the transmit frequency. The VFO A/B TXA control allows split operation using the two built-in VFOs, receiving on VFO B and transmitting on VFO A. This is especially useful for operating strange splits on fm. Normal + 600-kHz or − 600-kHz repeater splits and simplex operation are controlled by the RPT switch on the bottom panel of the FT-480R. The F-SET switch on the front panel eliminates the fractional frequencies that might occur if one switches from the low end of the band to the fm portion of the band. For example, if you are operating on 144.213 MHz and wish to QSY to 146.52, you may go up frequency in 100-kHz steps (MODE switch at FM) until you reach 146.513 MHz. Then, press the F-SET switch, and the transceiver operating frequency becomes 146.500 MHz. From there you move in 20-kHz steps to 146.520 MHz.

One of the nicer features is the frequency memory. If you have several favorite repeater frequencies you use often, you can program them into the memory and call them up with the ease of a crystal-controlled radio. The MEMORY control, ganged along with the STEP switch, allows the operator to choose among any four frequencies in memory. To load a frequency, simply set the MEMORY switch to one of the four positions, dial up the desired frequency using the main tuning dial and touch the M (memory) button. When calling up any of the memory channels, touch the MR (memory recall) button, which transfers frequency control from the main dial to the MEMORY switch. To return frequency control to the main dial, simply press the DIL (dial) button. If you want to retain the frequencies stored in memory after turning off the FT-480R, activate the BU (backup) switch on the rear apron, and the memory will continue to operate as long as dc power is connected to the POWER jack.

A scanning feature is built into the '480R. With the MEMORY switch in the MS position, the rig will scan all four memory channels. Push buttons on the microphone allow the operator to activate and stop the scan function. In addition, these push buttons allow the operator to scan up and down the entire 2-meter band in increments selected by the STEP control. With the mode switch in the FM position, you can use the SCAN switch on the bottom panel to have the rig stop scanning on either the first open or first busy channel it comes to. With the SCAN switch in the MAN position and the MEMORY switch in the MS position, you can switch through the memory channels at your discretion using the push buttons on the microphone. If you are operating from the main tuning dial and want to keep tabs on one of the frequencies in memory, the PRI (priority) switch allows you to scan one of the memory channels every five seconds. If the priority channel is in use or clear (your choice using the SCAN switch), the rig will automatically go to the memory channel.

In addition to displaying the operating frequency, one digit of the main readout also indicates which memory channel is in use. In the priority mode, the character P is displayed. An LED display in the upper left-hand corner of the front panel serves as an S meter on receive and as a relative power output indicator on transmit. LEDs indicate when the rig is transmitting and when the clarifier is activated. The BUSY/MOD indicator has a dual function; on receive, it lights when the channel is occupied, and during fm transmissions it indicates modulation.

Other Features

The transmitter section is rated at 30-watts input. A HI/LOW switch on the front panel allows operator selection of high- or low-power output. An indicator near the S meter lights when the rig is in the low-power position. The final transistors are VSWR protected; the higher the reflected power, the lower the output power.

Yaesu also recognizes that not all repeaters are carrier access. The T-CALL switch closes the PTT line and transmits an 1800-Hz tone for accessing repeaters. The CALL button on the microphone performs the same function. The TONE-IN connector on the rear apron provides easy access for the optional FTS-64 tone encoder, which synthesizes 32 PL or tone-burst frequencies. Other rear-apron jacks include antenna (SO-239), 1/8-inch (mm = in. × 25.4) key, external speaker and power connections.

The SAT switch, located on the bottom panel, is used for OSCAR work. This switch allows the operator to move the transmit frequency

*Assistant Technical Editor

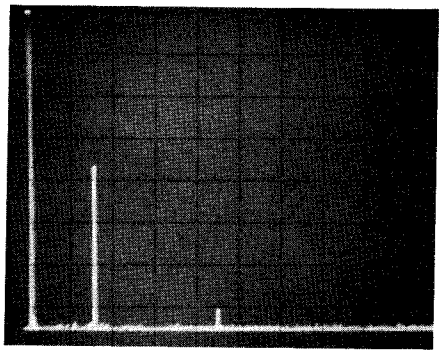


Fig. 1 — Spectral display of the FT-480R. Vertical divisions are each 10 dB; horizontal divisions are each 100 MHz. The fundamental has been reduced in amplitude approximately 36 dB by means of notch cavities; this prevents analyzer overload. Power output is 10 watts at a frequency of 146 MHz. The third harmonic is visible approximately 70 dB below peak fundamental output. Tests were performed in the ARRL lab. The FT-480R complies with current FCC specifications for spectral purity.

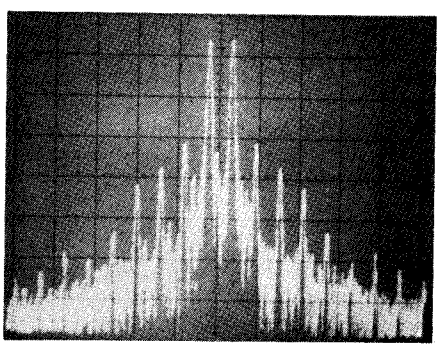


Fig. 2 — Spectral display of the FT-480R output during two-tone IMD test. Third-order products are 32 dB below PEP, and the fifth order products are 37 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at rated 15-watts PEP output on the 2-meter band.

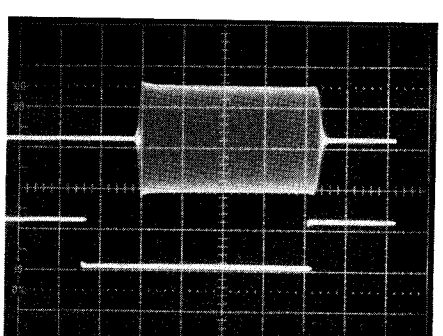


Fig. 3 — Cw keying waveform of the FT-480R. Horizontal divisions are each 5 ms. The upper trace is the output of the transceiver; lower trace is the actual key closure. There is a delay of approximately 6.5 ms between key down and actual output. This waveform will produce key clicks.

(while transmitting) to compensate for Doppler effect. This control should be left in the OFF position during normal operation because neither the VFO A/B TXA nor the CLAR function operates when the SAT switch is activated.

There's also a built-in noise blanker, activated by the front panel NB switch. This noise blanker was reasonably effective against airborne pulse-type noises.

Installation and Operation

Compact size makes the '480R a natural for mobile installation. Yaesu provides a universal mounting bracket that slides into guide rails on the sides of the transceiver, making it easy to take the rig in and out of the car. Power connections can be made at the fuse panel or the battery. Since I couldn't find a convenient access hole to the engine compartment, I used the accessory connection on my fuse panel. A 5/8-wavelength whip antenna completed my installation.

Mobile operation with the unit was a little difficult until I got used to the positions and functions of the controls. A few days of use solved this problem. When driving, I found it especially useful to program a few frequencies into memory and then to use the push buttons on the microphone to select among them. This feature made mobile operation much easier.

For home installation, Yaesu provides a wire mounting stand that supports the front of the transceiver. This stand performs two functions. It provides easier viewing of the front panel, and it allows audio to escape from the speaker located on the bottom panel. The manual recommends use of a 5-A, 13.8-V/dc power source. We measured the current consumption at 3 A in the ARRL lab, and my 4-A supply ran the radio for extended periods with no problem. I used beam antennas for both fm and ssb/cw operation from home.

Fm operation with the transceiver was a dream once I became familiar with the controls. The receiver is sensitive, the audio clean and the squelch smooth. I experienced no interference problems, even in areas with a repeater on every pair. All transmit audio reports I received indicated that the transmitted signal was clean and that my voice sounded natural. My only complaint is the intermediate 20-kHz fm channel steps. Often I found the 1-kHz steps too slow for easy frequency selection, so I switched to the 20-kHz steps and tuned right past my intended target. Yaesu says that the 20-kHz position may be converted to 5-kHz stepping through a simple modification. With a little practice, I found I could dial up even the strangest repeater splits with ease.

Being used to an hf transceiver with outboard transverter for the vhf ssb and cw operation, I was a little skeptical of the FT-480R because of its compact size. A few hours of operation convinced me that the rig is indeed capable of good performance on these modes. The 13 watts of output was enough to enjoy many local ssb contacts as well as a few with stations in the Philadelphia and Washington, DC, areas when band conditions were right. I consistently got good signal reports, with no evidence of splatter or distortion. Semi-break-in and a sidetone are provided for cw operation.

Receiver sensitivity was adequate for all but the weakest-signal contacts. As with most multimode vhf transceivers, a good outboard preamp is a valuable asset. On cw, the absence of a narrow filter sometimes caused problems, especially during times of crowded band conditions. Another annoyance in times of heavy activity was the excessively long agc release time.

I used the '480R during the ARRL VHF Sweepstakes contest with good results. The receiver held up even with several local stations running the full legal power limit. I was able to hear most of the stations that were on, and the transmitter easily drove a homemade amplifier that uses a pair of 4CX250B tubes.

I enjoyed using the FT-480R. The performance exceeded my needs, and I appreciated the convenience of having everything in one compact box. It was nice to be able to listen to 2-meter ssb without having to wire up the transverter. I would recommend this transceiver to anyone looking for a multimode 2-meter rig.

Station accessories available include the FP-80 power supply, FTS-64 tone encoder and AD-1 antenna coupler. Price class: $530. Manufacturer: Yaesu Electronics Corp., 6851 Walthall Way, Paramount, CA 90723. — *Mark Wilson, AA2Z*

Yaesu FT-480R Transceiver Serial No. OHO20232

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 143.500-148.500 MHz.	As specified.
Modes of operation: Fm, ssb and cw.	As specified.
Readout: Digital, 7-digit, fluorescent-blue digital display.	0.25-inch-high digits.
Resolution: 100 Hz.	As specified.
kHz/turn of knob: Not specified.	Ssb/cw: 0.5, 5, 50. fm: 50, 1000, 5000.
RIT range: ± 10 kHz.	As specified.
S-meter sensitivity (μV/S9): Not specified.	1.7.
Receiver sensitivity: Ssb, cw — 0.5 μV for 20-dB S/N; fm — 0.35 μV for 20-dB quieting.	Ssb, cw — 0.2 μV for 10-dB S + N/N; fm — 0.3 μV for 20-dB quieting. Noise floor (MDS) dBm: −133. Blocking DR (dB): 104. Two-tone, 3rd-order IMD DR (dB): 79.
Audio power output (8-ohm load): 2.0 watts at 10% THD.	1.02 watts at 10% THD.
Current consumption: Receive, dc 0.5 A; transmit, dc 3.0 A.	As specified.
Transmitter rf output: Fm/cw, 10 watts/1 watt; ssb, 10 watts.	Fm/cw, 13 watts/3 watts; ssb, 13 watts.
Spurious emission: At least −60 dB (ssb).	−70 dB.
Carrier suppression: Better than 40 dB.	As specified.
Third-order IMD: Not specified.	32 dB below PEP.
Size (HWD): 2.4 × 7.2 × 9.5 inches.	
Weight: 6.5 lb.	
Color: Two-tone gray.	

KENWOOD TR-7850 2-METER FM TRANSCEIVER

☐ This unit is a big brother to the TR-7800.[1] Front panel layout and operational features are exactly the same on both units, except the TR-7850 has an additional 6 dB of power output.

Operation with the '7850 in different environments proved to be flawless. At my home in Newington, Connecticut, I was able to work through many repeaters, some up to 75 miles away, using the high-power mode and a 1/4-wavelength ground plane up 40 feet and fed with 75 feet of RG-58/U. Coverage during mobile operation was exceptional. This area is very hilly, and holding a repeater for any distance is difficult. With 50 watts available, the range of coverage increased dramatically.

Power consumption in the high-power mode is 8 A. The power cord is heavy gauge and should be connected directly to the battery or fuse box to prevent excess voltage drop.

Observations

Kenwood has done a good job in the human engineering department with this rig. Although the front panel is quite small, people with large hands should have no trouble operating the controls. Perhaps the addition of tactile feedback (such as a "beep" upon key closure) on the keyboard would be useful for mobile operation so the operator would know when the key was hit without looking at the display.

For those who spend many hours on the highways or who live far from a repeater, the high power and versatility of the TR-7850 would be a great asset. The TR-7850 is distributed by Trio-Kenwood, 1111 West Walnut St., Compton, CA 90220, and is available from dealers throughout the U.S. and Canada. Price class: $450. — *Gerry Hull, AK4L*

[1]"Kenwood TR-7800 2-Meter FM Transceiver," Product Review, *QST*, Sept. 1981, p. 46.

Kenwood TR-7850 Serial No. 1110120

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 144.000-147.995 MHz	143.900-148.995 MHz.
Power requirements: 0.4 A receive, 9 A high-power transmit at 13.8 V.	0.4 A receive, 3 A low-power, 8 A high-power transmit.
Power output: Hi, 40 W minimum. Low, 1 to 15 W, depending on frequency.	High, 50 W. Low, 144.000—3 W, 145.000—6 W, 146.000—9 W, 147.000—12 W, 148.000—15 W.
Harmonic and spurious outputs: Not specified.	More than 70 dB down (see spectral photo).
Receiver sensitivity: Better than 0.5 μV for 30-dB S/N.	0.21 μV for 20-dB S + N/N.
Squelch threshold: Not specified.	0.15 μV.
S-meter sensitivity: Not specified.	S1 = 1.1 μV, S9 = 6 μV, 20 dB/S9 = 7.4 μV.
Audio output: More than 2 W across 8 Ω at 10% distortion.	1.8 W at 8 Ω.
Frequency display: 4, 1/2-in. red LEDs.	
Size: 6-7/8 × 1-1/2 × 8-5/8 in.	As specified.
Weight: 4.84 lb.	As specified.

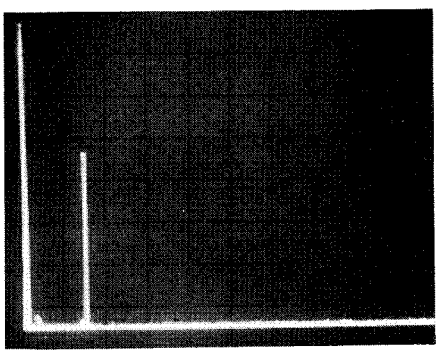
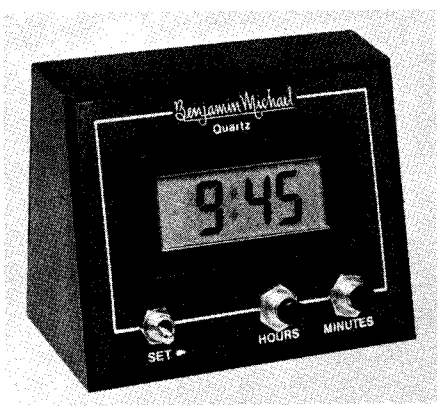


Fig. 4 — Spectral display of the TR-7850. Vertical divisions are each 10 dB; horizontal divisions are each 100 MHz. The fundamental has been reduced in amplitude approximately 33 dB by means of notch cavities; this prevents analyzer overload. Power output is 50 watts at a frequency of 146.94 MHz. Tests were performed in the ARRL lab. The TR-7850 complies with current FCC specifications for spectral purity.

BENJAMIN MICHAEL INDUSTRIES MODEL 173B STATION CLOCK

☐ Digital station clocks, especially those with readout in UTC, are as handy a station accessory as any ham could desire. The BMI 173B is a relative newcomer deserving attention: It is simple, functional and accurate.

The 173B has a black plastic case with a slanting faceplate for viewing ease. An LCD readout with highly visible 1/2-inch-high digits is provided; a flashing colon indicates the seconds with the 24-hour display. If you'd rather have an A.M. and P.M. indication, you can order the 12-hour version.



The clock face is uncluttered — a toggle switch for stopping the count and two momentary-contact push buttons for setting the hours and minutes. WWV synchronization is easy. Turn the SET switch on, and the clock seconds reset to zero and the display stops. Set the HOURS and MINUTES, then snap off the SET switch on the WWV tone. The clock has remained accurate within four seconds per month since I've had it, well within the 30-seconds-per-month maximum error claimed by BMI. One 1.5-V penlight cell powers the clock for about one year, according to the manufacturer. The clock module has outputs for an alarm and various other functions. Wiring details are available from BMI. A pleasing standard feature on the 173B is a backlight for the display actuated as long as the HOURS button is depressed; the backlight feature may be wired separately if a larger battery is used to power the clock.

Several versions of the 173B are available in addition to the 12- and 24-hour models discussed here. A panel-mount unit is designed for those who wish to add a flush-mounted clock to their operating-position console. Dual-display versions may be obtained for simultaneous local and UTC timekeeping. These models range in price from $32.95 for the 12- or 24-hour panel-mount clocks, to $124.95 for the dual-display Presentation Model housed in a walnut enclosure. They're available from Benjamin-Michael Industries, 65 East Palatine Rd., Prospect Heights, IL 60070. — *Sandy Gerli, AC1Y*

KLM 144-148-13 LB ANTENNA

☐ The 13 LB (13 elements, long boom) will perform with low VSWR across the entire 2-meter band. It can be mounted horizontally or vertically and can be stacked in two- and four-bay arrays.

Assembly instructions, assembly pictorial, dimension sheet and parts list are easy to read and the assembly pictorial mechanical drawing detail is excellent, showing the driven element and coax balun feedpoint connections. No problems were encountered during assembly, each step was explained very well. The ready-made RG-144/U 4:1 coaxial balun aided assembly. Making the connections simply involved slipping the balun terminals over the driven element and ground post studs, adding lockwashers and nuts, and tightening them. All electrical hardware is stainless steel.

Operating with this antenna at 40 feet[2] using 80 watts and a low-noise receiving preamplifier was all that was needed to work aurora with contacts from Nova Scotia to West Virginia and Indiana to Michigan from south central Connecticut. A total of 19 states and two Canadian provinces have been worked terrestrially. Five new states were added from west of the Mississippi as far away as South Dakota during an intense sporadic Es opening in July 1980. Distances of 150 to 200 miles are common communication ranges with this antenna and 80-watt power level during non-enhanced conditions. Long-range fm work is possible by rotating the antenna elements to the vertical position. Loosening the boom to mast clamp is all that is required, but for best results in the vertical position the manufacturer suggests using a hardwood, fiberglass or other non-conducting material for the mast.

Hundreds of OSCAR satellite contacts were made using this antenna for transmission and reception. When transmitting on 145 MHz, uplinks at elevation angles of 30° or less, 10 watts was sufficient to operate through the OSCAR 7 and 8 satellites on modes A and J. At elevation angles of over 30° an 80-watt amplifier was needed for good results. Receiving mode B on 145 MHz was good on the

[2]ft × 0.3048 = m, in × 25.4 = mm, mi × 1.609 = km, lb × 0.454 = kg.

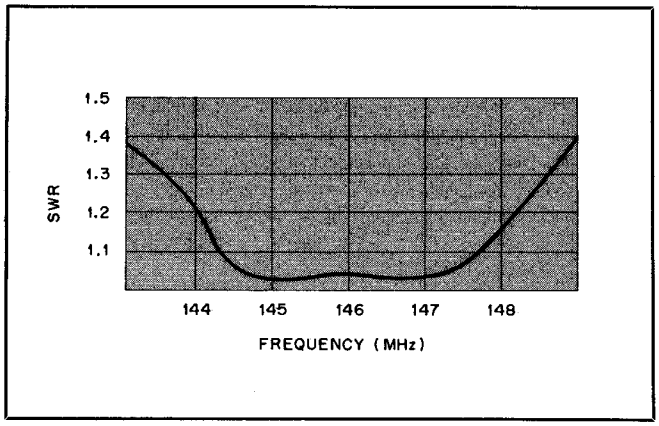


Fig. 5 — SWR curve for the KLM 144-148-13LB.

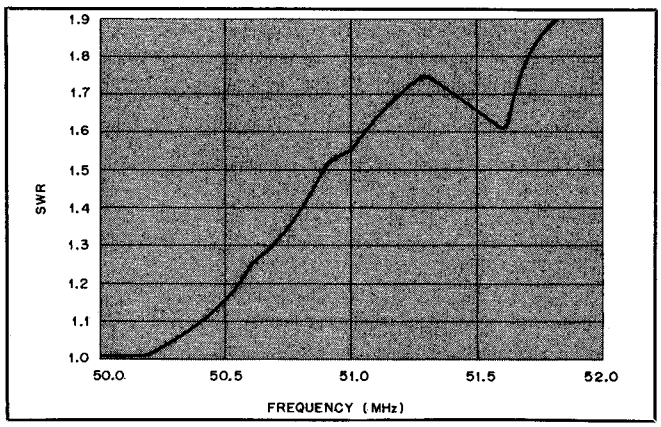


Fig. 6 — SWR curve for the KLM 50-7LD 6-meter Yagi.

KLM 144-148-13 LB Antenna

Manufacturer's Specifications

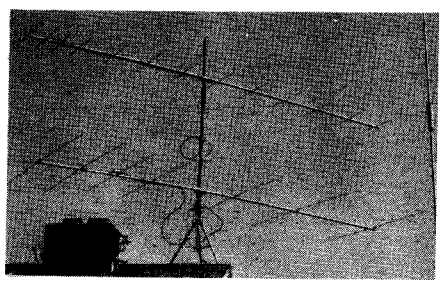
Frequency coverage: 144 to 148 MHz.
Number of elements: 13.
Power rating: 1 kW. (KLM 144-148-100N balun is recommended for powers greater than 1 kW.)
Weight: 9 lb.
Boom length: 21.8 feet.
Boom diameter: 1.5 inches.
Mounting: 4 × 8 inch plate for 2-inch mast to 1.5 inch boom.
Feed line required: 50 ohms unbalanced.
Feedpoint impedance: 200 ohms balanced, 4:1 balun supplied.
Longest element: 40 inches.
Shortest element: 31 inches.
Spacing dimensions: 2 bay, 13 to 15 feet between antennas. 4 bay, 14 to 16 feet between bays.
Manufacturer: KLM Electronics, Inc., 17025 Laurel Rd., Morgan Hill, CA 95037.
Price class: $90.

horizon, but there was too much fading at the higher angles. It is recommended that for maximum communications effectiveness through the OSCAR satellites, azimuth and elevation tracking antennas with switchable polarization be used.

Beamwidth and gain were noted when conducting front-to-side and front-to-back checks. This antenna is very directional and the received signals drop off sharply on a medium-strength distant signal, within about 15° of rotation. Most unwanted stations could be nulled out and this was very helpful during the ARRL VHF Sweepstakes. During the January SS event, 74 QSOs were made in 14 ARRL sections totaling 10 states, in eight and a half hours of operating time.

The most impressive feature of this antenna is the uniform VSWR across the entire 2-meter band. This is realized by the KLM design of dual, split, high-impedance driven elements and a low-loss balun matching system. One driven element is cut for a higher frequency, the other cut for a lower frequency.

With a 21.8 foot boom length and 13 elements, this is a ideal size beam for terrestrial and moonbounce communication. After one year of operating using this "long-boomer" my conclusions are that the KLM 144-148-13 LB will meet all expectations of performance and endurance that the most discriminating amateur could expect. — *Bernie Glassmeyer, W9KDR*



The KLM 144-148-13LB is mounted above the 50-7LD at W9KDR.

KLM 50-7LD 6-METER ANTENNA

☐ Erecting a 50-7LD — seven elements on a 20-foot[3] boom optimized for 50.1 MHz — says you're quite serious about a respectable signal on 6 meters. The LD stands for "light duty" and the manufacturer recommends use only in milder climates where extremely high winds and ice loading are not a problem. The review antenna has survived the Connecticut south-central coast weather for over a year. The only wind-created problem encountered occurred because the wrong element mounting blocks were supplied and a few of the elements broke off. A call to the factory revealed all of the seven blocks had to be changed. The bad blocks were brittle and could be broken by applying pressure at the end of the element. The new blocks could not be broken by hitting them with a sledge hammer while holding the blocks in a vise!

Wind loading is reduced by using a 1-1/2 inch boom and 3/8 inch elements, which keeps the weight at 12 pounds. This makes the antenna ideal for a moonbounce array if four 50-7LDs are stacked on an "H" frame. KLM will provide stacking information, but does not supply "H" frame or power dividers for 50 MHz.

Antenna assembly was delayed because the instruction sheets were missing and the coaxial balun sent was a 1:1 type instead of the 4:1 needed. Like all KLM antenna assembly instructions they are detailed, and with the use of good mechanical drawings the assembly is made easy.

Reviewing this antenna during the peak of solar cycle 21 added to the excitement of 6-meter operation — it's been my favorite band for many years. I've worked a number of new countries and states in the last year using this antenna and 200 watts' input power, with the antenna mounted at a height of 30 feet. A total of 21 countries and 47 states (needing only Montana, Wyoming and Utah for WAS) have been worked since putting up this antenna. Sporadic-E, F2, aurora, ground wave and scatter were all used with good success. One way to improve communication effectiveness is the addition of a bit more power. For this reason an old HT-33B was converted recently to 6 meters. This addition resulted in a 2 to 3 S unit increase in received signal reports.

Probably the most important aspect of using a beam having more than 3 or 4 elements on 6 meters, other than the additional gain, is the ability to null out unwanted signals. This can be used to advantage, especially during periods of high activity. The 50-7LD performed well in this respect, but still exhibited a 15 to 20° beamwidth when peaking a received signal. Some periods of intense sporadic-E or F2 propagation with backscatter disallow any specifications regarding antenna performance and leave one undecided as to which way to turn the antenna, but that's part of the fun of operating 6 meters!

Most often, when the step up from makeshift or small 2- or 3-element antennas is made, one realizes that a new operating dimension exists, taking you from occasional sporadic-E contacts to ground wave, scatter and aurora communications that exist every year regardless of the solar cycle. If you are contemplating operation on 6 meters or want a little more enjoyment, try a long-boom Yagi and see if you don't agree that it's the way to go on 6 meters! — *Bernie Glassmeyer, W9KDR*

[3]ft × 0.3048 = m, in. × 25.4 = mm, lb × 0.454 = kg, ft^2 × 0.093 = m^2

KLM 50-7LD 6-Meter Antenna

Manufacturer's Specifications

Frequency coverage: 50 to 51 MHz.
Number of elements: 7.
Power rating: 4 kW PEP.
Weight: 12 lb.
Boom length: 20 feet.
Boom diameter: 1.5 inches.
Mounting: 4 × 8-inch plate for 2-inch mast to 1.5-inch boom.
Feed line required: 50 ohms unbalanced.
Feedpoint impedance: 200 ohms balanced; 4:1 balun supplied.
Longest element: 122 inches.
Shortest element: 100 inches.
Wind area: 2 sq. feet.
Manufacturer: KLM Electronics, Inc., 17025 Laurel Rd., Morgan Hill, CA 95037.
Price class: $120.