

Ameritron AL-811 MF/HF Linear Amplifier

Reviewed by Bart J. Jahnke, KB9NM

Haven't we met before? The Ameritron AL-811 brings that question to mind as I recall other 811-tubed amplifiers, such as the Collins 30L-1 and the Heath Warrior (four-tube 811A workhorses introduced over 30 years ago). Many of these amplifiers are still in service today.

The AL-811 uses *three* parallel-connected 811A glass-envelope triodes in grounded-grid to develop over 500 watts output with a nominal driving power of 55 watts. The AL-811 is a medium-power amplifier made for those who don't want or can't afford legal-limit amplifiers. And, even though it isn't a 1500-watt amplifier, the AL-811 sometimes makes the difference between working a rare station on the first few calls versus being asked to repeat your call (several times!); being able to maintain schedules with a friend through poor band conditions or high noise levels; or participating in on-the-air nets—perhaps even serving as a net-control station.

The AL-811 covers all amateur bands from 1.8 through 29.7 MHz. (The amplifier comes from the factory with 12- and 10-meter transmission disabled, but if you send Ameritron a copy of your license, they'll send you the modification information. Also keep in mind that the FCC-specified maximum legal output on the 30-meter band for US amateurs is 200 W PEP.) Although the AL-811 was clearly designed with SSB and CW in mind, it can be run at reduced output on RTTY, SSTV, AMTOR, packet and 10-meter FM.

Inside

The AL-811 comes factory wired for 120-V ac operation. By changing power-transformer taps, you can wire it for input voltages of 100, 110, 220 or 230 V. At 120 V, the amplifier draws about 8 amperes at maximum output.

One power transformer provides the anode (plate), filament and control voltages. The anode supply develops 1700 V dc with no load. At full output, the anode supply drops to about 1500 V at my station. The 811As use directly heated (*filamentary*) cathodes, so they require a mere 3 seconds to warm up (I give 'em an extra 10 seconds or so for good measure). Interestingly, the tubes in the review amplifier were made in the former Soviet Union.

A rear-panel-mounted fan draws air into the amplifier and across the power transformer, where it pressurizes the chassis and exits to the left of the tubes (see Fig 1). The tubes are arranged in a row, such that some

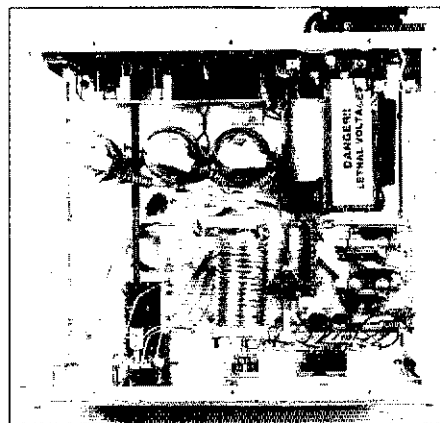
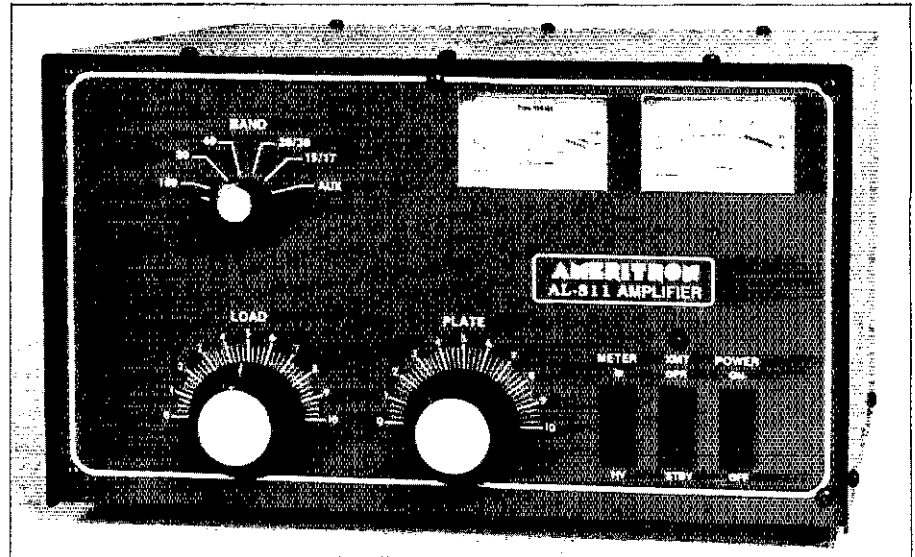


Fig 1—Inside view of the Ameritron AL-811.

cooling air flows over them. The amplifier's thermal design, however, doesn't seem very effective: Air isn't directed at and forced over the tubes, airflow through the amplifier seems rather weak, and a heat-reflective bare aluminum panel shields the input-network components from tube heat.¹ Still, the amplifier runs comfortably cool to the touch, and the tubes showed no signs of deterioration, physical or electrical, over the several-month-long evaluation.

¹R. Measures, "Circuit Improvements for the Heath SB-220 Amplifier," Part 1, *QST*, Nov 1990, p 26, explains how infrared radiation (heat) reflected into glass-envelope tubes by nearby surfaces can damage them. You can minimize this effect in the AL-811 by coating the aluminum shield with black paint or shoe polish.

RF Circuits

A pi-network tuned input matches the AL-811 for use with 50-ohm exciters. This is especially advantageous with today's solid-state transceivers, many of which begin to reduce power output at SWRs below 2:1. The AL-811 employs a conventional ALC circuit with a rear-panel-mounted level control. I found that the amplifier rarely requires more than 50 watts of drive, so the adjustable ALC circuit came in handy with my 100-watt transceiver.

The AL-811 also uses a pi-network output circuit. You switch bands via a six-position ceramic switch (the 12- and 15-meter bands share a band-switch position, as do the 17- and 20-meter bands). Of the two illuminated front-panel meters, one monitors grid current; the other is switched to display anode voltage or current.

Operation

The AL-811 is shipped in a single 30-pound box. A 10-page instruction manual comes with the amplifier. The instructions are adequate and the manual includes a schematic.

During the several weeks I ran the AL-811, I found it to be easy to use and reliable. It's quick and easy to adjust the amplifier for optimum performance. The AL-811 isn't equipped with a power-output indicator, so you'll need an external watt-meter and dummy antenna capable of handling at least 600 watts.

Ratings

According to *The ARRL Handbook*, the 811A is rated for a maximum anode volt-

Table 1**Ameritron AL-811 Linear Amplifier, Serial No. 1345****Manufacturer's Claimed Specifications**

Frequency coverage: 160, 80, 40, 30, 20, 17 and 15-meter amateur bands (10 and 12 meters included on export model).*

Power output: 600 W PEP, 550 W carrier for 30 s, 400 W carrier for 30 min.

Gain: Not specified.

Efficiency: Typically 70% (mode and power output not specified).

Driving power required: 55 W nominal.

Spurious signal and harmonic suppression: Not specified.

Intermodulation distortion (IMD): Not specified.

Power requirement: 100, 110, 220 or 230 V ac, 8 A max.

Color: Black.

Size (height, width, depth): 8 × 13.75 × 16 inches. Weight: 30 lb (including power transformer).

*The FCC-specified maximum legal output on the 30-meter band for US amateurs is 200 W PEP.

†The AL-811 required 72 W drive for 550 W output at 18.1 MHz. According to the manual, the amplifier should never be driven with more than 85 W.

Measured in ARRL Lab

As specified (can be modified for 12- and 10-meter operation by licensed amateurs).

As specified.

At 550 W CW output, 8.8-9.8 dB typically 9.3-9.6 dB; varies slightly from band to band.

At 550 W CW output, 53-60%; at 400 W output at 7 MHz, 71%.

57-72 W for 550 W CW output.† Drive required is typically 57-64 W and varies from band to band.

Meets FCC regulations. See Fig 2.

See Fig 3.

Not measured.

age of 1500, maximum anode and grid currents of 175 and 50 mA, respectively, a filament voltage of 6.3 and an anode dissipation of 65 W.² Ameritron rates the amplifier's no-load anode voltage at 1700 and its maximum total anode current at 700 mA (233 mA per tube, assuming that the tubes are electrically matched). In testing the review amplifier, we found that the full-load anode voltage was between 1300 and 1500, and it took between 590 and 700 mA of anode current to make the amplifier produce its rated 550 W of CW output (this rating is for 30 seconds; Ameritron rates the amplifier for 400 W continuous carrier output for 30 minutes). For instance, for 550 W CW output at 7 MHz (rated CW output under typical amplifier-operating conditions), we measured 57 W drive, 1470 V on the anodes, anode current of 590 mA and grid current of 118 mA. These conditions result in 924 W input and a total tube dissipation of 374 W (924 - 550), which means that each tube dissipates 125 W, or 92% more than the tube rating. On the other hand, at 400 W output at 7 MHz, each tube's anode sees about 120 mA and dissipates only 54 W, well within the 811As' safe operating region. (This discussion assumes that the tubes are electrically matched, also.) The bottom line: Keeping the AL-811's output at or under 400 W will provide best long-term reliability.

The AL-811 is obviously not optimized for operation at 12 and 17 meters. Its input SWR is rather high on these bands (over 3:1 at 12 meters and just under 2:1 at 17 meters), as the input networks used on these bands are optimized for the 10- and 20-meter bands, respectively. Considerably higher anode current and RF drive are also required on these bands, but the amplifier works fine at reduced output. Whether you can use it depends mainly on whether your transmitter is capable of safely delivering adequate drive into an unmatched load.

Conclusions

Why use three tubes? Why 811As—tubes that predate World War II? Only Ameritron may know for sure, but availability and low cost are certainly two good reasons. A quick glance through price lists shows that 811As sell for up to about \$15 each. Some retailers sell matched pairs and matched sets of four tubes; even four tubes (under \$75 total) are only a little over half the cost of a single 3-500Z triode, which makes the AL-811 the most economical medium-power amplifier, in terms of tube cost, available today. And, unlike sweep tubes, the 811A is intended for RF use. Modern amplifier tubes typically produce third-order intermodulation-distortion (IMD) products of -40 dBc or better; perhaps surprisingly, even though the 811A has been around for so long, the AL-811 performs similarly (in terms of IMD) to many modern amplifier tubes.

In dollars per watt, the Ameritron AL-811 is a strong competitor at the low-

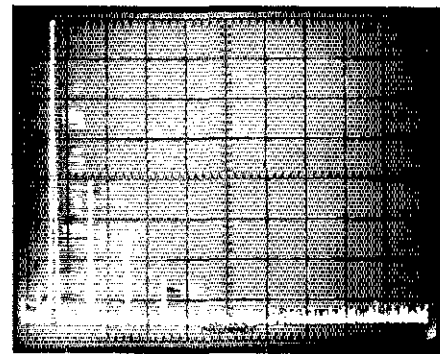


Fig 2—Ameritron AL-811 worst-case spectral output. Horizontal divisions are 10 MHz; vertical divisions are 10 dB. Output power is approximately 550 W at 1.8 MHz. All harmonics and spurious emissions are at least 40 dB below peak fundamental output. The AL-811 complies with current FCC specifications for spectral purity for equipment in this power-output class and frequency range.

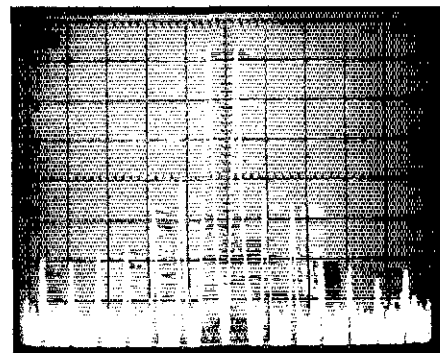


Fig 3—Worst-case spectral display of the AL-811 during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 40 dB below PEP output, and fifth-order products are approximately 46 dB down. Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The amplifier was being operated at 550 W PEP output at 14.2 MHz.

power end of the MF/HF amplifier market. Knowing that you can entirely retube this amplifier for around \$50, coupled with Ameritron's reputation for building high-quality, affordable amplifiers in several classes, is also comforting.

Thanks to Rus Healy, NJ2L, for his contributions to this review.

Manufacturer's suggested retail price: \$650. Manufacturer: Ameritron, 116 Willow Rd, Starkville, MS 39759, tel 601-323-8211.

CUSHCRAFT A50-6S 6-METER BEAM

Reviewed by Mark J. Wilson, AA2Z

"Bigger is better" is an axiom often applied to beam antennas. The new Cushcraft A50-6S isn't any bigger than its predecessor, the A50-6, but it certainly is much better. The A50-6S is an all-new

²C. Hutchinson and J. Kleinman, Eds, *The ARRL Handbook for Radio Amateurs*, 1992 edition (Newington: ARRL, 1991), p 35-8.